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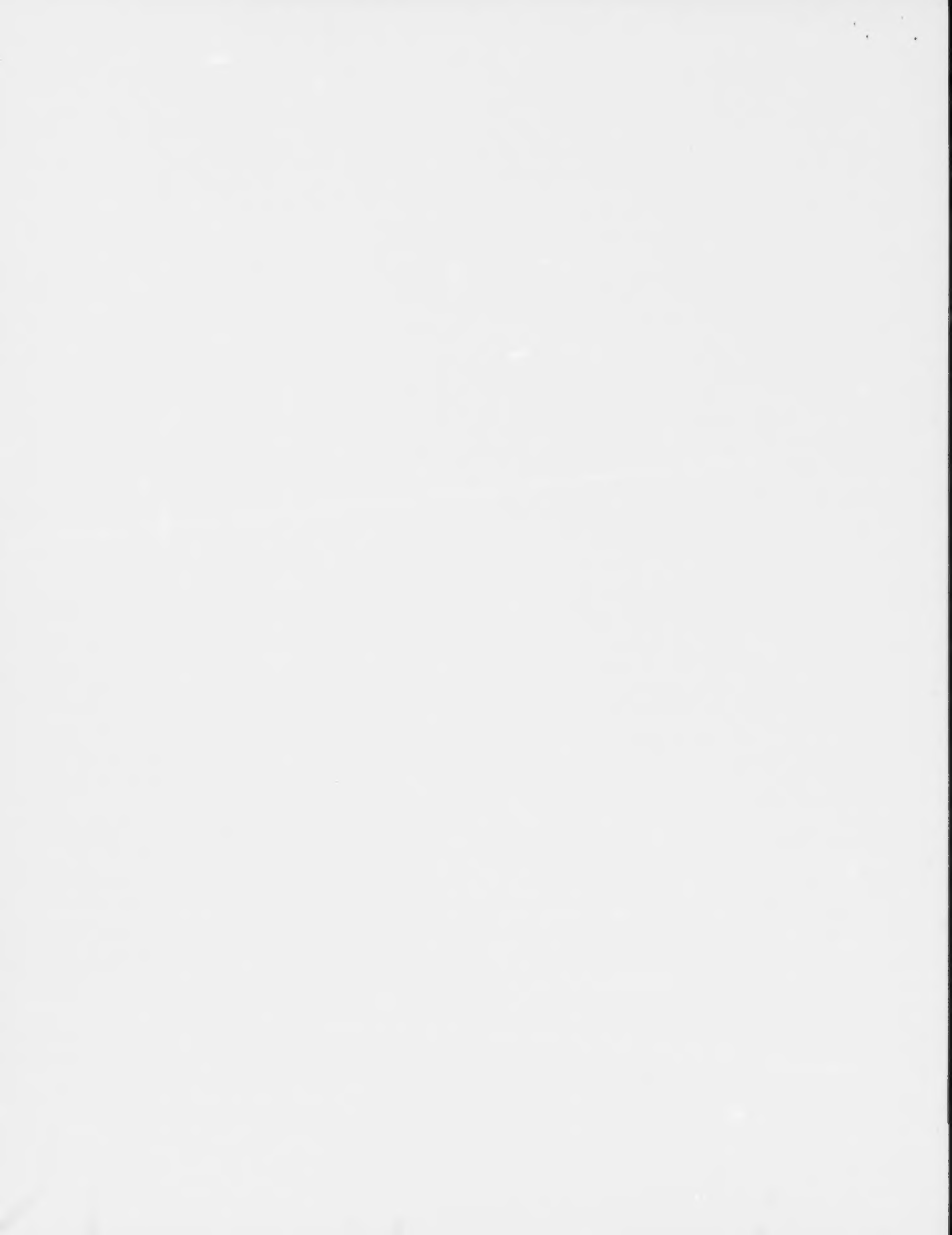
FINAL REPORT

20000146

IMPROVING FUSARIUM HEAD BLIGHT
RESISTANCE IN BARLEY FOR SASKATCHEWAN
AND MANITOBA

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Incorporation of Fusarium Head Blight Resistance Screening in CDC Breeding Programs for Barley

Final report on ADF project #20000146
August 4, 2000 – December 31, 2003

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A) ABSTRACT

The objective of this University of Saskatchewan (CDC)/AAFC, Brandon collaborative project was to improve *Fusarium* head blight resistance in barley for the eastern Prairie region. Funding came from Manitoba ARDI, Saskatchewan ADF and AAFC MII; and from WGRF Barley Check-off, Saskatchewan ADF, AAFC and the University of Saskatchewan base budgets. The project ran from August 2000 through December 2003. The 2000 FHB nursery at Brandon was successful with more than 10,000 lines screened, 2770 evaluated for DON and 1000 tested in a China nursery. The 2001 FHB nursery at Brandon was successful with 16,200 entries screened, 6,200 evaluated for DON and 2,000 tested in a China nursery. The successful 2002 nursery contracted to < 15,000 entries with 2000 screened in China. The successful 2003 nursery had 16,604 entries with 9,700 plots harvested for DON testing. Results are encouraging with all breeding programs having selections with improved tolerance, especially among 2R hulless and 2R hulled materials. A number of lines from both CDC and AAFC programs have consistently shown lower FHB ratings and lower DON contamination. The project provided revised variety ratings for FHB to the three Prairie provincial variety recommending committees and FHB data for all western Canadian barley Cooperative Registration trials. An off-season screening nursery was operated in China during 2000/01, 2001/2002 and 2002/03. Several 1000 foreign germplasm introductions were evaluated for FHB tolerance during the four years. Best selections have been utilized in all four participating breeding programs. While not part of the original objectives a screening technique utilizing NIRS to evaluate nursery samples for DON content and capable of eliminating those samples with very high DON levels prior to expensive ELISA evaluation has been developed.

B) EXECUTIVE SUMMARY

The overall objective of this CDC University of Saskatchewan/AAFC, Brandon collaborative project was to improve *Fusarium* head blight (FHB) resistance in barley for the eastern Prairie region of western Canada. Funding for the overall project came primarily from Manitoba ARDI, Saskatchewan ADF, AAFC MII and the base budgets for the CDC and AAFC barley R&D efforts which come from the WGRF Barley Check-off, Saskatchewan ADF, AAFC and the University of Saskatchewan.

The project was initiated in 2000 by expanding the FHB nursery at Brandon to 9,200 rows and 3,200 hill plots, occupying about 80% of its maximum area which was reached in 2001 when 16,200 entries were evaluated. A new irrigation system was constructed and the nursery was successfully inoculated with *Fusarium graminearum* using infected corn seed. While the original project was to allow for significant screening of CDC breeding materials by covering a portion of the Brandon FHB nursery costs for 2000, 2001 and 2002 and to end at June 30, 2003, the Saskatchewan ADF was foresighted enough to allow funds to be carried through until December 31, 2003 which, along with other funds cobbled together from several sources, allowed the Brandon FHB nursery to operate for a fourth year during 2003 and to continue to accommodate CDC breeding materials.

The Brandon FHB nursery was successful during all four seasons and has become the premier barley FHB screening facility in Canada. The challenge now is to obtain sustained funding to keep the nursery operational for the foreseeable future. Heading dates were recorded and visual FHB ratings were taken on a 0-5 scale at an exact number of days post-heading for each row. Lodging was rated as it may be a confounding factor as severally lodged entries are usually highly infected. *Cochliobolus sativus* which produces spot blotch and is difficult to distinguish from FHB was controlled using Tilt.

During each of the four years, the total number of nursery entries and screening methods varied. Methods varied based on learning from each previous year. In 2000, the nursery included 12,416 plots (7,680 1.5-m rows, 1,536 0.9-m rows and 3,200 hill plots) with 3,406 plots harvested. Significant variation associated with FHB disease reaction has been observed in barley. Evaluation of entries in the nursery using hill plots was less consistent than rows, thus hill plots were discontinued. In 2001, the nursery grew to 16,200 plots of 1,800 1.5-m rows and 14,400 0.9-m rows, with higher priority materials grown in the longer rows with 7,882 rows harvested. The 0.9-m rows demonstrated similar variability as 1.5-m rows, thus were more efficient in assessing FHB. In 2002, the entire nursery (14,400 plots) was sown to 0.9-m rows. The decrease in the total number of rows seeded from the previous year was due primarily to seed shortages at the CDC/ University of Saskatchewan because of drought conditions in 2001. While total rows were less, the number harvested increased to 9,728 due to an increased level of replicated materials. The 2003 nursery consisted of six banks of 0.9 meter rows for a total of 16,604 entries, with 9,700 harvested. In general, the FHB nursery at Brandon has been highly productive in generating invaluable foundation data which has guided progress towards improvement of FHB tolerance in barley.

The nursery was inoculated with grain spawn (i.e. corn seed infected with 3 isolates of *Fusarium graminearum*) spread on the ground 3-5 times at weekly intervals beginning before heading of the earliest lines and irrigated to promote disease development. In 2001, a supplemental experiment was conducted to assess the use of Tilt and Dithane to control *Cochliobolus sativus* (causal agent of black point, kernel discolouration, spot blotch, seedling blight and common root rot in barley). *C. sativus* can confound FHB research through incorrect diagnosis of analogous disease symptoms or inter-species disease competition. Results indicated Tilt could be employed without adversely affecting *Fusarium* development. In 2001 and thereafter, 1-2 blanket treatments of Tilt were applied to the nursery prior to the first application of corn inoculum. All entries were rated visually for FHB on a 0-5 scale (0 = no symptoms, 5 = severe symptoms) about 3 - 3.5 weeks after heading. At the time of disease assessment, a lodging score was assigned to each plot using a 1-9 scale (where 1 is erect and 9 is flat). Depending on the function of the sub-test visual FHB scores were used to produce a reduced subset of selections for harvest and DONN testing.

Of utmost importance to the malting barley and animal feed industries is the production of a variety with low mycotoxin, specifically deoxynivalenol (DON). In barley, visual FHB scores are poorly correlated with DON, thus extensive DON testing is required. Grain harvested from each FHB nursery plot was cleaned and 20 g subsamples were ground. A 1 gram subsample was sent to Dr. Marc Savard's lab, Eastern Cereal and Oilseed Research Centre (ECORC), Ottawa,

for DON analysis using ELISA. In 2000, 2,770 samples were tested for DON. This number rose to 6,198 samples in 2001, 5,204 in 2002 and 5,000 in 2003. Several hundred 2003 samples will be ELISA tested for DON at NorWest Labs.

Along with 50 additional DON assays conducted on samples originating from a 1999 FHB nursery, several hundred samples from the current 2000 – 2003 project and their corresponding DON data have been used at the Crop Development Centre (CDC) to develop NIRS calibrations to use the NIRS6500 as a tool to predict DON levels in ground and unground barley samples. This work suggests our NIR calibration is accurate enough to eliminate the very high DON samples meaning at least those do not have to be evaluated using ELISA. This methodology may allow selection in early generation populations deferring the substantial cost of ELISA testing to more advanced materials.

To monitor micro-environmental fluctuations across the nursery, repeated check sets were positioned after every 50 experimental plots. Variation observed among checks shows expression of this disease is strongly influenced by environment. The most common check set was: AC Metcalfe (2-row, MRMS reaction), CI4196 (2-row, R reaction) and Stander (6-row, S reaction). Although its use was still continued, in 2001 CI4196 was replaced by Zhedar #1 (2-row, R reaction) in several check sets due to its better agronomic performance. The second most common check set, used to monitor 6-row materials, was: CDC Sisler (6-row, MRMS reaction), Chevron (6-row, R reaction) and Robust (6-row, S reaction). In 2001, a third set was adopted and used in significant a portion of the nursery: CDC Stratus (2-row, MRMS reaction), Harbin (2-row, R reaction) and Excel (6-row, S reaction). Repeated check means and their associated standard errors (Table 1) give an indication of the variation observed within and between years. Expression of DON content was strongly influenced by year. DON content exhibited a ten-fold increase in 2001 over 2000, with 2002 and 2003 falling between those. Interpretation of DON data in the presence of such incongruities is not straightforward, thus requires multiple years of testing individual entries to produce reliable conclusions. The use of simple mean values across years may also be misleading and in fact it may be most appropriate to assume that the worst reading of any set of data across tests may unfortunately be the most important when selecting among lines.

During each winter 2000/01 through 2002/03 we conducted a FHB nursery in Hangzhou, China providing a second annual cycle of disease screening and an assessment of materials in a nursery free from *C. sativus*. 1,000 entries, were sent in 2000/01 with 2000 in each subsequent year. Data supplied by our Chinese colleagues included the number of days to heading, % of diseased spikes/row, % of infected seeds and a disease index = $(\text{Diseased type} \times \text{Spike number of each diseased type}) / (\text{Total spikes} \times 4)$, where Diseased type was scored 0–4 with 0 = no disease through 4 = 3/4 or more of the spike diseased). Overall correlations between China and Brandon data were generally low, although similar patterns were observed between genotypes. Disease pressure in Hangzhou was variable over the three years as demonstrated by mean check levels (Table 2), with row type showing an interaction with year. Photo-period effects and other environmental influence may have contributed to the weak agreement with Brandon results. China data was also received each year too late to be useful in making selections before the next Canadian field season. In collaboration with Dr. K. M. Ho, AAFC, ECORC, Ottawa, we conducted experiments to further understand the relationship between FHB visual ratings and

DON content in the FHB nurseries in Canada (including several eastern Canadian sites) and China. The results thus far have demonstrated a parallel pattern of low correlation between data from China and that obtained from other Canadian locations.

While data obtained from the 2000-2002 FHB nursery at Glenlea was not useful due to unfavourable environmental conditions acceptable FHB data was obtained from the 2003 nursery. 750 plots were grown in the 2003 FHB nursery at Glenlea, MB. Low levels of disease were observed, but preliminary DON analysis indicated that testing will be worthwhile. Another small FHB nursery at Charlottetown, P.E.I. was used to evaluate 1,000 rows of advanced breeding materials in 2003. Between these two supplementary nurseries, 1,000 2003 samples will be analyzed for DON content at ECORC. These nurseries are intended as a backup for the large Brandon nursery, and provide replication of higher priority selections as well as alternate site evaluation to confirm improved tolerance in said selections.

A major contribution from the building barley FHB data base from the Brandon FHB nursery began following the 2001 season since we had sufficient data from 2000 and 2001 to be able to re-evaluate FHB ratings of various varieties available to prairie barley growers. These variety ratings were provided to the three prairie provincial committees responsible for the production of the annual provincial Seed Guides and variety recommendation lists and was subsequently included in those publications for 2002, 2003 and 2004.

Although improving FHB resistance will be a long-term effort, good progress was made during the four years of the project. Valuable information was provided to producers through the Provincial Seed Guides on the FHB resistance of current barley varieties. Without this project, the information would have been fragmented and incomplete. It also gave barley breeders a better idea of the FHB resistance of their varieties to better plan their breeding efforts. One of the disappointing findings of the project was that the FHB resistance of some two-row malting varieties, e.g. AC Metcalfe and CDC Stratus, were not as good as thought at the outset of the project. A number of two-row varieties appear more resistant to FHB than AC Metcalfe but these tend to be early or highly susceptible to spot blotch. Few six-row varieties surpassed CDC Sisler, although the six-row blue-aleurone malting varieties, Argyle and Tankard, appeared to be more resistant. However, there is no longer a market for this class. Bedford and Bronco were best six-row feed varieties and were comparable to CDC Sisler for DON. Two-row hulless barley varieties, like CDC Freedom, look very promising and have the lowest DON content of all classes. Unfortunately this class has been struggling for market share in recent years. The six-row hulless varieties, AC Hawkeye and AC Bacon, compare favorably with two-row varieties in terms of DON. The hulless trait may be partly responsible for this, but looking at the six-row group in particular, there are hulless varieties with very high DON.

The project also provided data on FHB resistance for potential varieties in western Canadian Cooperative Registration trials. Without this project, there would have been no data in 2000 – 2003 since the Glenlea FHB nursery failed all three years. A few varieties were registered over the past three years with improved FHB resistance over AC Metcalfe (two-row check) or CDC Sisler (six-row check). The two-malting varieties, Calder and CDC Goodale, may have lower DON content than AC Metcalfe, while the two-row feed variety Ponoka from Alberta looks promising. One of the most promising lines in the two-row Coop test during this time was

TR361, which was supported but not registered due to high susceptibility to spot blotch, an important disease in the FHB region. From the hulless cooperative test, CDC Rattan from the CDC was the most promising line registered in terms of FHB resistance. It is expected that more lines with improved FHB resistance will be entering the registration tests over the next few years as a result of the research done under this project.

Germplasm exchange has taken place with researchers from eastern Canada, the USA, New Zealand and ICARDA/ CIMMYT. Since some of these researchers have been working at this problem longer, we hope to identify FHB resistant lines to use for crossing to improve FHB resistance. In 2002 and 2003 we participated in the North American Barley Scab Evaluation Nursery (NABSEN). Although only having 8 entries, AAFC, Brandon and CDC lines performed well and were comparable to American lines specifically selected for FHB resistance. These elite lines may have the potential to become new varieties in western Canada or serve as parents for crosses. It is hoped that germplasm exchange and collaboration will build on this base and increase in future.

The best known sources of FHB resistance are CI4196 in two-row and Chevron in six-row types. Both are undesirable from an agronomic point of view, susceptible to other diseases and have unacceptable quality. Their resistance will also break down if infection levels are high. It would therefore be desirable to identify new sources of resistance to complement them or that are in a more desirable background. For this purpose, we have screened a large number of lines from Plant Gene Resources of Canada, as well as advanced breeding lines from European, New Zealand and Australian barley breeding programs. A number of lines have been identified with promising FHB resistance, but additional testing will be needed to confirm the results and determine their suitability in terms of agronomic, disease resistance and quality traits. This will be a long-term process.

All barley breeding programs in western Canada have at least some lines with moderate resistance to FHB surpassing AC Metcalfe or CDC Sisler. Most moderately resistant lines in registration trials to date have been identified from existing breeding material, but new lines specifically bred for FHB resistance are now being advanced through the breeding programs. Of particular note are 25 AAFC Brandon breeding lines from 10 crosses involving known sources of "exotic" FHB resistance including AC Sterling, Chevron, CI4196, Gobernadora, Harbin, Morrison, Siejo II, Symko, and Zhedar I. Note that AC Sterling, Morrison and Symko are actually eastern Canadian varieties which we had not been using until recently. These 25 lines have shown consistently lower DON levels than AC Metcalfe over several years of testing in FHB nurseries.

Of note in the six-row and hulless barley breeding program at AAFC, Brandon is the two-row hulless line EX645-3-6 which has low DON content and will be evaluated in the 2003 NABSEN test. A number of six-row lines, both hulless and covered, with low DON content have also been identified and will be advanced through the breeding program.

The CDC/ U. of Sask. barley breeding programs have identified and advanced many breeding lines with promising FHB resistance relative to AC Metcalfe and CDC Sisler. Some of these may eventually become new varieties for the eastern prairie FHB region. Of particular interest

are lines from the non-malting program from crosses involving CDC Freedom, CI4196 and HDE84194 as resistance sources. Some of these are being evaluated at the yield test stage. Advanced selections with consistently lower DON levels include TR02185 and TR03376 in the 2003 2R WCoop trial.

It is expected that new two-row hulless, feed and malting barley varieties with improved FHB resistance will be registered over the next 5 years. The order of the classes listed above is probably the order in which the new varieties will be released with two-row malting barley being the most difficult and slowest because of super-imposed quality constraints. Improvements in FHB resistance, as indicated by lower DON levels, will be incremental in nature – no large reduction in DON content is expected in the near future. It may be 10 years before new six-row varieties with significantly lower DON levels than CDC Sisler are registered.

In vitro selection (IVS) in conjunction with DH production was evaluated as a tool for generating or enhancing new and existing sources of FHB resistance and for screening populations segregating for FHB resistance. *Fusarium* mycotoxins, such as DON, were added to the anther culture media either alone or in combination with other mycotoxins at varying concentrations and times. Cells with tolerance to the mycotoxins were regenerated into plants. We were successful in developing protocols for IVS that allowed us to regenerate DH plants, but the results from the field have been somewhat disappointing to date. Of particular interest are several lines derived from the six-row malting variety Excel which may have reduced DON levels. Further testing will be needed to confirm these results. One of the main reasons for using IVS on varieties and resistance sources was to develop protocols that could be successfully used in screening populations segregating for FHB resistance. Unfortunately, *in vitro* selection was successful only in 2001 for the two-row sub-population of the Chevron/CDC Fleet cross and in 2002 for the Rivers//Rivers/SB93806 breeding cross. Research currently underway has been extended to isolated microspore culture since the AAFC breeding program now utilizes this technique for routine DH production. If IVS is successful, it offers many advantages to the breeding program. However, even if IVS is not successful, lines identified with improved FHB resistance (from either IVS or control groups) will be advanced in the breeding program.

A number of DH populations have been developed for potential genetic studies on FHB resistance, but additional funding will be needed to proceed further. This is beyond the mandate of the current project.

A new objective was added at the CDC to develop a calibration for NIR to determine DON content more rapidly, easily and cheaply than possible with current methods. Results to date are encouraging, but the accuracy of the equation in predicting DON content will need to be improved using more samples containing a wide range in DON values from different varieties grown at various locations over a period of time. This calibration has been developed for ground samples. An equation based on whole grain also shows promise but many more samples must be added to improve accuracy. This would eliminate grinding and make initial screening prior to ELISA significantly more efficient. The number of samples that can be analyzed for DON content is a bottleneck in improving FHB resistance in barley.

The two CDC breeding programs per se evaluated nearly 12,000 entries in the Brandon FHB

nursery during the 2000 through 2003 growing seasons. Of these some 4,400 samples were evaluated for DON. The breakdown of all CDC materials evaluated follows:

Year	# Entries Bdn	Rows Harvest Bdn	DON tests Bdn	# Rows China	# Entries Glenlea	DON tests Glenlea	# Entries Charri	DON tests Charri
<i>Rossnagel/ Zatorski</i>								
2000	1000	170	170	114				
2001	2583	800	800	372				
2002	2010	843	700	402				
2003	2500	1483	750		150	42	300	189
<i>Total</i>	<i>4510</i>	<i>3296</i>	<i>2420</i>	<i>888</i>	<i>150</i>	<i>42</i>	<i>300</i>	<i>189</i>
<i>Harvey /Lefol</i>								
2000	600	196	196	146				
2001	2523	1034	945	374				
2002	1074	351	351	275				
2003	1229	365	365		150	55	86	86
<i>Total</i>	<i>5426</i>	<i>1946</i>	<i>1857</i>	<i>795</i>	<i>150</i>	<i>55</i>	<i>86</i>	<i>86</i>
<i>CDC Total</i>	<i>9936</i>	<i>5242</i>	<i>4277</i>	<i>1683</i>	<i>300</i>	<i>97</i>	<i>386</i>	<i>275</i>

In conclusion, the funding provided by ADF along with other agencies has laid the groundwork for developing new barley varieties with improved FHB resistance. This is critical to the well being of all aspects of the barley industry in Manitoba and eastern Saskatchewan.

C) TECHNICAL REPORT

Project Objectives

The overall objective of this project was to improve Fusarium head blight (FHB) resistance in barley for western Canada.

Specific objectives were as follows:

- 1) Evaluate current barley varieties, all entries in registration trials, and advanced breeding lines from the AAFC Brandon and CDC/University of Saskatchewan programs for FHB resistance. The Alberta Agriculture Field Crop Development Centre, Lacombe, may enter some advanced breeding lines in the nursery at its own expense. This information would assist producers in choosing which varieties to grow as well as assist the breeders in selecting lines for future crosses and the most promising crosses for exploitation. Approximately 1,500 slots were dedicated to this objective each year.
- 2) Exchange elite germplasm with promising FHB resistance with other barley breeding programs, such as North Dakota State University, University of Minnesota and ECORC, each year. About 200 slots per year were used for this objective.

- 3) Evaluate new putative FHB resistant parents from all possible sources each year. About 200 slots were designated for this use.
- 4) Evaluate lines from crosses segregating for known sources of resistance, such as CI4196, or from crosses between two moderately resistant lines with different backgrounds. Select the most promising lines for further research and crossing. This objective required the most space with about 3,000 slots for AAFC Brandon, 3,000 for the CDC/University of Saskatchewan, and 1,500 for Alberta Agriculture (at own cost) each year.
- 5) Develop a protocol for in vitro selection of FHB resistant barley lines using DON or other mycotoxins in anther/microspore culture. Use this protocol to identify new sources of FHB resistance and develop recombinant lines resistant to FHB in all classes of barley. About 500 slots per year were allocated to this objective.
- 6) Develop and evaluate special doubled haploid populations for determining the inheritance of resistance.
- 7) Added objective -Development of DON calibrations for NIRS6500 at CDC.

PROGRESS

Objective 1. Barley varieties and co-op entries

Each year, FHB ratings and DON data were provided to the co-ordinators of the Western Co-operative Barley tests, Eastern Prairie Barley Test and Mississippi Valley Test for inclusion in their reports. In 2002, entries from the Western Coop Forage Barley test were included. In total, 463 to 547 rows and 151 to 177 DON tests were used for this purpose per year. Over all three years, two-row germplasm showed higher levels of resistance to FHB than six-row germplasm, with the difference less pronounced in 2002 (Table 3). Since the FHB nursery at Glenlea failed to provide any useful data in 2000 - 2002, except for 2003, this was the only source of information on resistance to this important disease for entries in registration trials in western Canada.

Several Western Co-operative test entries over the past four years have shown improved FHB resistance vs best checks (Table 4). Entry TR361, a CDC two-row feed with moderate FHB resistance, was supported for registration at the 2002 Prairie Registration Recommending Committee for Grain (PRRCG), but was not registered due to high spot blotch susceptibility. Ponoka (TR01656), a two-row feed from Alberta Agriculture, Food and Rural Development (AAFRD) had lower DON than AC Metcalfe over two years of testing. TR01711 from W.G. Thompson/Agricore United (undergoing further testing at the Collaborative Test level) showed consistently low DON over two years. Although not proposed for registration TR01655 (AAFRD) and TR01711 (WPB) showed lower DON over two years as has TR02185 in 2002 and 2003. Unfortunately no 6 row WCoop entries have demonstrated lower DON than CDC Sisler. Several entries in the Western Co-operative Hulless Barley Registration Test have shown reductions in DON content compared with their checks. While the hulless character is associated with lower DON levels, certain hulless lines obviously have additional tolerance to FHB as exemplified by the 2 row CDC Freedom and the 6 row AC Bacon. The most variation between entries was observed in this test over the four years (Table 3). Some extremely susceptible hulless entries observed within this test (e.g. Falcon) indicate that hull removal is not the only mechanism conveying tolerance. The CDC two-rowed waxy variety CDC Rattan (HB364)

registered in 2003 showed lower DON levels than most checks in 2001 and 2002, as did HB362 (not proposed for registration). Other promising entries with lower DON were: HB368, HB370, HB371, HB376 and HB377 from the CDC, HB701 and HB702 from WPB and HB614 from AAFRD. HB376, HB377, HB701 and HB702 may be advanced for further testing in 2004. Two row entries in the Western Coop Forage Barley test showed good FHB reactions: FB201 (tested over 2 years) from the CDC and FB402 and FB405 (AAFRD) and FB203 (CDC) - tested for one year.

Most entries in the 2000 Eastern Prairie Barley Test had lower DON content than AC Metcalfe. Hulless lines SH99654 and SH99643 and two-row covered line BM9647D-56 in the 2001 Eastern Prairie Barley Test showed considerable improvement in DON content over AC Metcalfe. Two hulless entries in the 2002 Eastern Prairie Barley Test from the CDC (SH99616 and SH00251) had the lowest DON content in the test. Also noteworthy in the test were the two-row covered lines BM9507-109 and BM9744-14 from AAFC Brandon and SB00364 from the CDC. In 2003 BM9611-5 and EX680-7-12 from AAFC Brandon stood out as best for DON.

In 2001 and 2002, all entries in the advanced eastern Canadian six-row and two-row tests were evaluated, using 50 to 86 plots and 49 to 59 DON tests. Two-row entries AB241-1 and Sunderland showed lower DON levels than the moderately resistant checks over two years. Other two-rows, CH9512-13, CH9528-10, CH9508-2 and Benefit showed low DON from one year of testing. The six-row entry, Brucefield has shown DON levels approaching CDC Sisler over two years testing, but visual ratings have been poor. This is contradictory to results collected on this variety in eastern Canada, which indicated it does accumulate DON. From one year of testing six-row entry OB4998-5 showed lower DON than CDC Sisler.

For 2001 - 2003, we have provided FHB ratings based on the FHB visual ratings, DON content and FHB ratings from the 2000-01 FHB nursery in China (Table 5) for current western Canadian varieties to the committees that develop the western Provincial Seed Guides. 289 to 310 plots and 288 to 309 DON tests were used for this purpose each year. Special efforts were made each year to have the DON data analyzed in time to be included in determinations for the following year's Seed Guide FHB ratings. As for the Western Coops two-row covered entries showed lower DON content than six-row covered entries. This divergence of reaction to FHB between the row-types was also noted in the visual ratings assessed both at Brandon and Hanzhou, China. Within the two-row covered group, AC Bountiful (AAFC, Bdn), Conlon (NDSU variety), CDC Copeland, CDC Dolly, CDC Fleet, CDC Unity, Deuce, Harrington (all from the CDC) and Seebe (AAFRD) show consistently low DON. Unfortunately, most of these two-row varieties, except Conlon, are also susceptible to spot blotch (*C. sativus*), which has become a concern for barley production in the eastern prairies. For the six-row covered group: Argyle, Bedford, Bronco, CDC Sisler and Tankard consistently show best FHB reactions. Hulless entries frequently showed lower DON content than the covered entries within the same row type. Again significant variation was observed between hulless varieties, especially within the six-row hulless group where a few highly susceptible, semi-dwarf varieties (Falcon, Jaeger and Peregrine) had a strong influence on increasing the average DON value for that group. In contrast, AC Bacon and AC Hawkeye have good DON content, at a level similar to the two-row hulless varieties. Utilization of varieties from the two-row hulless group, such as CDC Candle, CDC Rattan, CDC Dawn,

CDC Freedom, CDC Speedy (all from the CDC), Condor and Phoenix (AAFRD) shows promise for lowering DON levels.

Each year, 74 to 117 advanced breeding lines from AAFRD were assessed for FHB reaction. AAFRD is actively involved in breeding for FHB resistance and screening lines in a FHB nursery at CIMMYT in Mexico. A total of 127 to 220 plots and 41 to 50 DON tests were used for this purpose per year. Nine two-row covered lines, initially identified in 2000-01 and subsequently retested in 2002, demonstrated moderate resistance. Five of the lines have been discontinued in the AAFRD breeding program due to poor agronomic performance, but may have value as parental germplasm.

Objective 2. Germplasm exchange

During the project Dr. K. M. Ho and Dr. G. Fedak, ECORC, AAFC Ottawa, provided germplasm with potential FHB resistance for evaluation in the Brandon FHB nursery (Table 7). 10 six-row AC Stephen/ Chevron selections were evaluated in 2000. In 2001, these lines were re-evaluated with 23 additional entries from this population and 30 selections from the six-row Chapais/ Chevron cross. The AC Stephen/ Chevron population showed the best resistance and six AC Stephen/ Chevron lines were again evaluated in 2002 and in 2003. During 2002 and 2003 we also participated in a collaborative test coordinated by Dr. Ho to determine the relationship between FHB visual ratings and DON content in FHB nurseries in Canada and China.

Materials provided by Dr. Fedak included intraspecific crosses with wild barleys (*Hordeum spontaneum* and *Hordeum bulbosum*). Sixty-four Mona/ *H. spontaneum* and 36 Ingrid/ *H. spontaneum* barley lines were tested in 2000 with three and six lines, respectively, selected for further study in 2001. Two lines were selected for further testing from the Ingrid/ *H. spontaneum* cross, with line 2-3 demonstrating the best resistance over all years. In 2002, 44 barley lines derived from crosses with *H. bulbosum* were tested, and four were selected for future study. Selections from Dr. Fedak's research program are potential contributors of FHB resistance from outside the *H. vulgare* genome. Further research will be needed to determine if the genes imparting the observed resistance are novel and useful.

In 2001, six elite six-row lines were tested from the Dr. K. Smith's Univ. of Minnesota breeding program. One 6 rowed line (FEG 18-40) showed lower DON levels than the resistant check (Chevron), and was selected for further evaluation in the 2002 nursery where it showed a similar DON level to Chevron.

In 2001, 85 F₄ six-row lines plus 10 parental lines from a collaborative project lead by Busch Agricultural Resources Inc. (BARI) were evaluated in the FHB nursery. A subset of 20 lines that showed lowest DON values over all locations and those that were lowest at Brandon was re-tested in 2002. Of these lines, C00-6070 was selected for future consideration.

Eighty three lines with reputed FHB resistance from ICARDA / CIMMYT were evaluated in the 2001 FHB nursery. Fifteen lines were selected for further study in 2002. Resistance was generally poorer than expected.

In 2002 and 2003 western Canadian breeders participated in the North American Barley Scab Evaluation Nursery (NABSEN, formerly known as the MINNDAC nursery) where elite germplasm is evaluated for FHB resistance over multiple locations. Participants, besides the four Canadian breeding programs were: U. of Minn., North Dakota State University (NDSU), BARI and ICARDA/ CIMMYT, although the latter did not submit entries in 2002 or 2003. 248 nursery rows and 123 DON tests were utilized. In 2002 Canadian breeders submitted current varieties with moderate FHB resistance (with the exception of EX699-5-4, an experimental line from AAFC, Brandon-Therrien). FHB resistance of the current Canadian varieties was not much different than that of USA entries from institutions specifically breeding for FHB resistance (Table 8). Of particular note in the Canadian group was the two-row hulless variety CDC Freedom, which had the lowest DON content over all locations. Conlon, a two-rowed covered variety from NDSU, also performed well overall. Please refer to the following web site for full report summary of 2002 NABSEN test:

http://www.scabusa.org/pdfs_dbupload/02_NABSEN_Rep.pdf In 2003 elite FHB resistant lines from the U. of Minn., BARI., NDSU and ICARDA/ CIMMYT and 8 lines from western Canadian breeding programs were evaluated at six FHB nurseries in the United States, one in Toluca, Mexico and at Brandon. Half the Canadian breeding institutions tested registered varieties, with the other half submitting experimental lines. Preliminary results indicate that several western Canadian entries (especially EX645-3-6 and EX702-4-6 from AAFC Brandon and SH01265 and SB00106 from the CDC) measured up well against best lines from the USA.

In 2003 we also evaluated several FHB resistant, 2-row lines from Dr. Jerry Franckowiak's breeding program at NDSU, Fargo. These tests took up about 300 rows. 60 samples were analyzed for DON.

Other germplasm exchange evaluations are described in individual breeding program sections under Objective 4.

Objective 3. New sources of resistance

Throughout the project 49 to 58 accessions with reputed FHB resistance from various sources have been evaluated together in a test (Table 9). A total of 157 to 187 rows and 58 to 159 DON tests per year were used for this purpose (for 2001-02, DON tests were performed on composite samples). The best two-row FHB resistance sources are: CI4196, Golozernyj 1, Harbin and Ussurijskij 8 with Krasnojarskij 1, Nepolegajuscij, Niedzical, Primus, Svanhals, Svansota and Zhedar #1 in the next best category. Chevron and 6NDRFG-1 (two years data only) are the best six-rows. 6NDRFG-1 (PI615583), is a six-row selection from the NDSU cross Foster/ CIho 4196. Although we have been able to identify the best sources of available FHB resistance through this test, i.e., CI4196 for two-row and Chevron for six-row, the resistance in these lines breaks down when disease pressure is increased. Many of the existing resistant sources possess undesirable qualities such as extreme heading dates and/or heights. Identifying a better resistance source would be desirable.

Recent two-row malting barley varieties from Europe have been tested over the past three years. A total of 54 to 154 rows and 14 to 31 DON tests per year were used for this purpose. Several

European varieties (Angie, Cicero, Scarlett, Birte and Havanna) have shown lower DON levels and will undergo further evaluation.

For each of 2000 - 2003, we have evaluated 500-567 Plant Gene Resources of Canada (PGRC) accessions originating from Asia, Africa and Eastern Europe with hopes of identifying a novel source of FHB resistance (Table 11). Twenty-eight lines with good FHB reaction in 2001 were re-evaluated in 2002 with 10 lines forwarded to the 2003 nursery. Thirty-one lines, evaluated for the first time in 2002 were re-tested in 2003 (Table 12). This purpose used 531 to 687 rows and 72 to 106 DON tests per year. Of special interest in the 2002 batch of lines from the PGRC were 12 FHB resistant six-row accessions previously identified by Dr. B. J. Steffenson (U. of Minn.). Seven of these FHB resistant six-row lines were re-assessed in 2003.

In 2002, 104 Ethiopian Accessions from the Cereal Research Centre (CRC), AAFC Winnipeg, previously screened for FHB resistance (Dr. A. Tekauz and Dr. B. McCallum) were included in the FHB nursery. The seed source for this test was harvested material collected in a FHB nursery from several years ago, so there were some germination problems. Analysis of the data has not been completed by the CRC yet.

In 2002, 89 entries from various Australian breeding institutions were assessed for FHB resistance. Of that total, 27 lines were tested for DON content and 14 were re-tested in 2003.

Objective 4. Advanced breeding lines and segregating crosses

When evaluating various breeding materials in the FHB nursery over the last four years, some lines have frequently appeared in the pedigrees of FHB resistant breeding lines more often than not. Lines/varieties that deserve particular mention are local genotypes AC Bountiful (TR243), Calder (TR262), CDC Freedom, CDC McGwire, TR238, TR244, TR250, TR251 and TR253, and the introductions CI4196, Svanhals, HDE84194-622-1, Gobernadora, AC Sterling and Harbin,

Among local lines, along with CDC Freedom, TR238 has been one of the most consistent, and is a parent of Calder and TR253, and a sister line of AC Bountiful. Preliminary results indicate the TR238 is more resistant to FHB than any of its parents, suggesting many additive genes are involved in the resistance. Also of note TR244 and TR251 are from the same cross, but are both prone to hull peeling which could lower DON content.

Two-row Malting Barley Program, AAFC, Brandon – Dr. W.G.Legge

A total of 25 lines from 10 crosses with known sources of FHB resistance have entered advanced yield tests at five sites in 2003. Crosses to FHB resistance sources were initiated in 1996. Early generation material has been selected over several years of testing in FHB nurseries. Lines included in the advanced yield tests generally have lower DON content than AC Metcalfe and reasonable agronomic and quality performance. All lines have also been evaluated for resistance to other diseases. Another 38 sister lines from these same crosses with good FHB resistance but inferior agronomic traits have been entered in replicated Preliminary Yield Tests in 2003 to further assess their potential as parental germplasm.

Of lines included in advanced tests, BM9637-53 and BM9637-149 from the Gobernadora/AC Metcalfe cross have shown the most consistent FHB resistance. Line BM9671-23 from the AC Metcalfe//Gobernadora/TR244 cross has exhibited very good FHB resistance, but is inferior agronomically. Double haploid lines from the Harbin/TR253//TR253 cross have shown a positive combination of FHB resistance complimented by good agronomic performance. Although we have appraised Chevron, CI4196 and Zhedar 1 as some of the best available sources of resistance, production of progeny derived from crosses to these lines with acceptable agronomic characteristics has been difficult. Along with the exotic sources of resistance, three two-row varieties with moderate FHB resistance from eastern Canada have also been used in several advanced breeding lines. Of the three, AC Sterling appears to be a better source of FHB resistance than Symko and Morrison. No double haploid lines derived from the Svanhals cross included in 2002 replicated Preliminary yield tests were entered in advanced 2003 yield tests.

Initial results indicate that although improvements have been made in FHB resistance, these gains may be accompanied by trade-offs with resistance with other important pathogens such as spot blotch (*C. sativus*) and stem rust (*Puccinia graminis* f. sp. *tritici*). Several lines do not appear to carry *Rpg1*, a gene which confers broad-spectrum resistance to stem rust. That being said, several of the lines with Gobernadora in their background appear to also possess resistance to scald as demonstrated by field and laboratory tests.

Forty-two non-doubled haploid lines from 5 crosses to FHB resistance sources Zhedar 1, Chevron, Harbin, Svanhals and Shyri were advanced to replicated Preliminary yield tests in 2003. Of these, lines with Chevron in the parentage generally showed the lowest DON levels.

Early generation populations from five crosses including Morrison, AC Oxbow, Zaoshu 3 and Ussurijskij 8 as sources of FHB resistance were evaluated in the 2001 and 2002 FHB nurseries. Of these, 125 lines were selected for further evaluation in the 2003 FHB nursery. Two additional crosses, involving SM99292 as a potential source of resistance, were also evaluated in 2002 with 96 lines being advanced to 2003 tests.

AAFC, Brandon forage, feed, food, hulless and 6-row malting project – Dr. M. Therrien

Between 297 and 612 lines from the six-row and hulless barley program at AAFC, Brandon were evaluated in each of 2000-2003 in the FHB nursery at Brandon. All entries were replicated with repeated checks.

Results show that all selected material was a considerable improvement over the susceptible check varieties Robust and AC Rosser. Hulless lines responded best, with the hulless two-row line EX645-3-6 showing the best overall DON levels. This line is being evaluated further in multiple FHB Nurseries.

Although the nursery infection and DON levels varied considerably over years, relative values were consistent over replicates and years. In looking at these trends, malt and feed lines demonstrated a poorer rate of improvement relative to the hulless lines. This would indicate that progress in improving FHB resistance, and (more importantly) low accumulation of DON, for malting and feed lines in our program, would be slow and require large numbers to make any practical gains. By contrast, the hulless germplasm responded well and a moderate rate of improvement is expected.

Nearly all of the hulled lines tested were six-row. Approximately half the hulless lines were two-rowed. Since six-row barley is generally more susceptible to FHB, the results were not surprising. There is also evidence to suggest that DON accumulates in the hull of the barley kernel. Since hulless barley de facto loses the hull upon threshing, the reduced levels of DON were not unexpected. Thus, the best likelihood of getting a new variety with low DON accumulation is via selection in hulless, two row germplasm.

CDC non-malting project – Dr. B.G. Rossnagel, T. Zatorski & D. Voth

Advanced CDC non-malting barley selections with improved FHB ratings and DON levels:
CDC Rattan (HB364) – 2 row hulless waxy barley supported for registration in 2003. Lower DON than best checks in 2001 and 2002.

TR02370 – 2 row hulled feed barley in 2002 2R Coop trial. Lower DON than best checks in 2001 and 2002, but not advanced due to other deficiencies.

HB371 – 2 row hulless barley in 2003 HBCoop with lower DON than best checks in 2002 and 2003. Not being put forward for registration as it does not offer enough advantage over CDC Rattan.

HB377 – 2 row hulless selection in 2003 HBCoop with low DON in both 2002 and 2003.

TR361 – 2 row hulled selection in 2000 & 2001 2R Coop trial with lower DON than best checks. Supported for registration but not registered due to high susceptibility to spot blotch.

TR03376 – 2 row hulled selection in 2003 2 Row Coop with low DON in 2002 and 2003.

2R hulled entries in 2003 Eastern Prairie Barley Trial with lower DON than best checks in 2002 and 2003 – **SB01465, SB01513 & SB01522.**

Advanced hulled selections showing lower DON than best checks in 2002 and 2003 in 2003 CDC Standard Yield trials: **SB01045, SB01133 & SB00106.**

Advanced hulled selections showing lower DON than best checks in 2002, advanced to 2003 CDC Misc. Yield trials and re-tested for FHB:
SB01646, SB01039, SB01518 & SB01215.

Advanced hulless selections showing lower DON than best checks over three years 2001 through 2003 and in advanced 2003 CDC Yield trials:
SH01436, SH01690, SH01265, SH01380, SH01399

Advanced hulless selections showing lower DON than best checks in two of three years 2001 - 2003 and in advanced 2003 CDC Yield trials:
SH01089(6 row), SH01723, SH01776, SH01224, SH01381, SH01354, SH01392, SH01224, SH01616, SH01402, SH02360, SH02365,

Crosses showing particular promise include the following parents:

CI4196 and HDE84194-622-1 from China
 2ND16029 from North Dakota State University
 TR251 and TR244 from AAFC Brandon
 CDC Freedom, CDC McGwire, CDC Candle and TR361 from the CDC

Three hullless CDC selections which have all shown consistently low DON levels over three years in the FHB nursery have been used extensively in recent crossing blocks.

SH00749 from the cross CDC Freedom x CI4196

SH99717 from the cross SB89497 x SR93162

SH99454 from the cross CDC Freedom x TR251

Crosses are working through various stages of the breeding program from F1 through to Standard Yield trials with DON level being a major selection criterion at the advanced YT stage where the material can fit into the Brandon FHB nursery.

2x haploid populations developed – limited numbers reached reached FHB testing stage in 2003. Bolded parent better for FHB. Crosses include:

MC#	Pedigree	# of 2x haploids
MC9950	HDE84194-622-1/BM9203-74	3
MC9951	HDE84194-622-1/HB353	21
MC0040	CI4196/CDC Helgason	106
MC0059	CI4196/CDC McGwire	31
MC0112	SH99119/SH98236	189
MC0154	HDE84194-622-1/CDC Helgason	219
MC0156	HDE84194-622-1/CDC McGwire	28
MC0160	SB99158/CDC Trey	221
MC0170	SH00749/CDC McGwire	92
MC0133	TR361/TR263	8
MC0159	2ND16092/TR361	10

FHB populations advanced to F5 via SSD 2000 – 2003:

Pedigree	F3 F4 SSD year	# of F5 RILs	# RILs advanced
CDC Silky/Chevron	98/99	187	59
CDC Freedom/CI4196	98/99	106	106
HB352/CI4196	98/99	165	165
HDE84194-622-1/HB353	00/01	176	34
TR361/TR01363	01/02	192	29
2ND16092/TR360	01/02	184	31
CI4196B/CDC Helgason	01/02	96	18
CI4196B/CDC McGwire	01/02	182	25
TR361/TR710	02/03	168	TBA '04
TR361/TR263	02/03	196	TBA '04
HDE84194-622-1/TR357	02/03	128	TBA '04

HDE84194-622-1/CDC McGwire	02/03	164	TBA '04
2ND16092/TR361	02/03	200	TBA '04
HB364/HB361	02/03	236	TBA '04
SH00749/CDC McGwire	02/03	200	TBA '04
SH00749/TR361	02/03	156	TBA '04
2ND16092/CDC McGwire	02/03	200	TBA '04

Heritability of low DON:

While specific studies to evaluate the heritability of low DON have not been undertaken and DON data can be highly variable from year to year in the nursery low levels do appear to be heritable. During the testing of several 1000 CDC genotypes from a large number of cross combinations conducted at Brandon over the years 2000 – 2002, CDC Freedom appeared in 21/58 pedigrees of breeding lines exhibiting low DON levels. Similarly HDE84194-622-1 appeared in the pedigree of 12/58, TR251 in 10/58, CI4196 in 10/58, BM9303-74 in 9/58, HB328 in 8/58, TR244 in 6/58 and CDC McGwire in 5/58 of lines exhibiting low DON.

As shown in the following tables a number of hulled and hulless CDC selections consistently demonstrate low DON levels (as determined by testing over repeated years and by replicated testing in the 2002 and 2003 nurseries) and will continue to be evaluated as long as the Brandon FHB nursery can accommodate such.

Table 1. CDC 2R hulled selections demonstrating low DON - replicated 2003 testing.

Identification	Pedigree	2000 DON	2001 DON	2002 DON	2003 DON	2003 DON Glenlea
CI4196	Check	2.5	30.3	9.5	13.5	7.3
AC Metcalfe	Check	2.8	31.7	11.9	10.9	9.5
SB01045	SB93413/CDC Dolly			2.9	5.9	
SB00106	TR339/TR251		23.5	3.2	6.7	6.6
SB01300	CDC Gainer/CDC Freedom/TR251		13.8	4.0	8.6	
SB00253	CDC Dolly/92Ab4206		28.6	4.1		
HDE81194-622-1	Chinese intro	2.0	17.1	4.3	4.5	
SB01521	HB350/SB96002			4.4	10.4	
SB01133	TR339/TR251//Baronesse			4.4	6.5	
2ND16092	USA intro	0.9	15.6	4.9	5.0	4.5
MC9950-025 (SB02737)	HDE84194-622-1/BM9203-74			4.9	7.4	
SB00534	TR336/TR251		18.4	6.0	4.7	8.6
SB01693	91Ab/M83/AC Bacon/CDC Earl		8.2	4.2	5.5	6.4
SB01699	91Ab/M83/AC Bacon/CDC Earl		8.3	1.6	6.6	10.0
SB01702(MC9775 -003)	Lysimax/CDC Freedom		9.9		5.1	11.1
SB01086	TR340/TR251		4.1	5.1	8.0	3.5

SB01087	TR340/TR251		2.9	5.7	7.0	14.4
SB01689	91Ab991///M83//AC Bacon/CDC Earl			7.6	5.5	
SB01089	TR340/TR251		13.8	8.2	7.0	
SB01174	TR251/TR970		13.7	5.4	6.9	
SB01300	CDC Gainer/CDC Freedom//TR251		13.8	4.0	8.6	
SB02495	HDE84194-622-1/BM9203-74			8.5	3.9	

Table 2. CDC 2R hullless seln's demonstrating low DON – replicated 2003 testing.

Identification	Pedigree	2000 DON	2001 DON	2002 DON	2003 DON	2003 DON Glenlea
CI4196	Check	2.5	30.3	9.5	13.5	7.3
AC Metcalfe	Check	2.8	31.7	11.9	10.9	9.5
CDC Candle	Check	1.1	9.7	4.0	3.0	
CDC Freedom	Check	0.9	13.7	7.8	4.2	
SH01265	CDC Freedom/C2-83-6-12		8.3	1.6	1.3	
99T511-03-027	CDC Freedom/CI4196	0.7	13.5	2.0	1.4	4.5
99T511-03-058	CDC Freedom/CI4196	0.4	7.6	2.1	1.0	
99T511-03-059	CDC Freedom/CI4196	0.3	8.8	2.9	1.1	
SH00766	HB328/TR244		10.4	3.0	1.6	
SH01723	SB94912/CDC McGwire			3.0	3.4	
SH01228	CDC Freedom/TR251			3.3	3.1	
SH99616	CDC McGwire/TR251	1.0	13.9	3.3	2.3	5.5
SH01399	CDC Freedom/CI4196		6.2	3.7	2.9	
SH01231	CDC Freedom/TR251		11.6	3.8	3.5	
SH99640	HB328/TR244	1.0	19.8	3.8	2.9	
SH00749	CDC Freedom/CI4196	0.5	9.1	4.0	1.9	12.4
SH00009 (6R)	AC Bacon/92-55-06-54		11.3	4.0	7.1	
SH01431	CDC Gainer/CDC Freedom//TR251		8.6	4.0	2.1	
SH01434	CDC Gainer/CDC Freedom//TR251		9.8	4.1	2.0	
SH01436	CDC Gainer/CDC Freedom//TR251		8.6	4.1	3.1	
SH01195	CDC Freedom/HB334		18.6	4.2	4.2	
SH00306	CDC Freedom/SB94917		14.3	4.4	8.0	
SH00283	CDC Freedom/SB94917		12.2	4.6	6.3	
SH01214	HB337/CDC Dolly		14.6	4.6	9.1	
SH01562	CDC McGwire/91Ab991		9.6	4.8		
SH01616	4176n/CDC McGwire			4.9	3.1	
99T511-03-014	CDC Freedom/CI4196	1.0	14.7	4.9		
SH99637	HB328/TR244	1.6	11.4	4.9	5.0	
SH01232	CDC Freedom/CI4196		10.4	5.0		

SH99717	SB89497/SR93162	1.4	8.7	5.4	4.7	
SH99454	CDC Freedom/TR251	1.3	9.8	6.9	na	
SH00682	SB94282/TR247		8.0	5.8	2.0	5.5
SH00766	HB328/TR244		10.4	3.0	1.6	4.4
HB348	HB320/Maresi	1.4	14.5	5.1	4.1	5.8
99T511-03-097	CDC Freedom/CI4196	1.3	12.2	4.4	2.4	4.7
SH01228	CDC Freedom/TR251		10.4	3.3	3.6	
SH01525	HB328/TR251		9.7	6.1	4.6	
SH01690 (AC9706-301)	HB328/TR244		4.4	6.3	1.8	

Interspecific introductions

As part of the CDC's ongoing efforts to source unique germplasm for resistance to various diseases, including FHB, a number of introductions from international collaborators have been evaluated whenever possible in the Brandon FHB nursery.

The first promising set of materials are germplasm lines from Dr. R. Pickering, Crop & Food Research, New Zealand which contain introgressions from *Hordeum bulbosum*. Some 50 such lines were tested in 2002 and 2003 with three lines showing low DON in both years. These lines will be evaluated in future FHB nurseries to confirm resistance and if confirmed we will endeavour to determine if the *H. bulbosum* introgressions are responsible for that.

NZ #	NZ ID	2002 DON	2003 DON
81882/83	2001 RP-01	6.8	5.5
926K2/12/6/3/6/2	2001 RP-03	5.6	3.5
36L53/1/3-7/2/1	2001 RP-08	4.7	3.0

The second promising set of materials are germplasm lines from P. Hayes at Oregon State University derived from a cross between *H. vulgare* and *H. spontaneum*. Some 150 lines were evaluated in 2002. It was quickly noted that this whole group of lines had lower FHB symptoms and DON levels. The 25 lines showing lowest DON were retested in 2003. Results are very encouraging in that all 25 lines has relatively low DON again in 2003. This is especially interesting since work by others in the USA has not indicated that *H. spontaneum* is an especially rich resource of FHB tolerance.

OSU ID	2002 DON	2003 DON
RCSLYT-056	0.3	7.5
RCSLYT-055	0.4	4.1
RCSLYT-057	0.4	6.8
RCSLYT-118	0.5	9.4
RCSLYT-117	1.1	5.8
RCSLYT-052	1.2	6.9
RCSLYT-058	1.3	6.8

RCSLYT-001	1.5	6.3
RCSLYT-110	1.5	6.5
RCSLYT-059	1.8	3.9
RCSLYT-119	2.1	3.8
RCSLYT-002	2.4	5.6
RCSLYT-051	2.8	7.3
RCSLYT-087	2.8	3.6
RCSLYT-019	3.3	6.2
RCSLYT-115	3.5	6.9
RCSLYT-136	3.5	4.8
RCSLYT-114	3.6	7.2
RCSLYT-060	3.7	7.4
RCSLYT-089	3.8	6.8
RCSLYT-025	4.4	7.9
RCSLYT-127	5.1	5.1
RCSLYT-028	5.2	8.1
RCSLYT-022	5.5	8.3
RCSLYT-140	6.0	9.1

2003 Updates:

Special FHB selections: Three replicates of 139 lines and selections previously identified with low visual FHB symptoms and low DON in 2000 through 2002 FHB nurseries were re-tested in 2003. Based on 2003 FHB symptoms a set of lines was chosen for replicated DON evaluation. A summary of those results (shown below) indicates good progress in that nearly all selections had < 10 ppm DON.

Type	< 5ppm DON	5 – 9.9 ppm DON	10 – 19.9 ppm DON	20+ ppm DON
2R hulled	0	3	1	0
2R hulless	5	18	0	1
6R hulless	0	1	1	0

2003 Standard Barley YT entries: Single or 2 replicate FHB testing was conducted on 431 SFBYT entries. DON was measured on composite samples from 182 selections with lower field symptoms. A summary of those results (shown below) indicates good progress in that a high portion of the selections had < 5 or < 10 ppm DON.

Type	< 5ppm DON	5 – 9.9 ppm DON	10 – 19.9 ppm DON	20+ ppm DON
2R hulled	1	26	47	0
2R hulless	74	101	0	0
6R hulless	3	8	0	0

2003 Preliminary Barley YT entries: Single replicate FHB testing was conducted on 78 PFBYT entries. DON was measured on 45 selections with lower field symptoms. A summary of those

results (shown below) again indicates good progress in that a good portion of the selections had < 5 or < 10 ppm DON.

Type	< 5ppm DON	5 – 9.9 ppm DON	10 – 19.9 ppm DON	20+ ppm DON
2R hulled	5	19	14	2
2R hullless	6	9	1	0

CI4196 x CDC Helgason doubled haploid population: 103 doubled haploids from the cross CI4196 x CDC Helgason were evaluated in the 2003 FHB nursery in two replicates. All individual samples were evaluated for DON. Averaged over replicates the population had a normal distribution of DON levels as shown below, indicating quantitative inheritance. Further evaluation of this population will be required to verify these findings. Best selections with low DON will also be advanced to 2004 yield trials.

Type	< 5ppm DON	5 – 9.9 ppm DON	10 – 19.9 ppm DON	20+ ppm DON
2R hulled	4	39	54	10

CDC Malting project – Dr. B.L. Harvey, Dr. E. Lefol & D. Voth

Beginning in 2000, the FHB Observation Nursery at the AAFC Research Station of Brandon allowed testing all of our advanced generations material (F6 and further generations) and some earlier generation selections.

Among the lines tested in the year 2000, 10 lines with lower DON content were selected and included in the 2001 crossing block. In addition to lower DON content, these lines showed good agronomic characteristics or good malting quality.

Name	Pedigree	Type	FHB Rating	DON (ppm)
AC				
Metcalfe		2R+h	3	29,1
CI4196		2R+h	1	43,9
SM00150	SM95096 / SM94043	6R+h	3	9,8
SM00158	SM95096 / SM94043	6R+h	2	11,3
SM00177	SM95265 / SM95086	6R+h	3	18,9
SM00279	SM95515 / SM95152	2R+h	3	10,8
SM00318	TR580 / SM94332	2R+h	3	11,0
SM00390	SM94337 / TR251	2R+h	2	14,4
SM00428	TR149 / TR251	2R+h	2	17,4
SM00443	SM96243 / TR248	2R+h	3	15,4
SM00518	SM94319 / IONA	2R+h	3	11,7
SM00537	SC94024 / SM94238	2R+h	3	9,8

In 2001, 16 lines were selected and used in the 2002 crossing block. These lines were either crossed with other lines from our program or with a foreign source of germplasm showing fusarium resistance.

Name	Pedigree	Type	FHB Rating	DON (ppm)
AC				
Metcalfe		2R+h	3	10,4
CI4196		2R+h	3	22,0
SM00393	SM94188 / TR149	2R+h	2	11,1
SM00467	SC96606 / SM94516	2R+h	2	10,8
SM00599	SM95152 / BM9014-10	2R+h	3	13,3
SM01059	BM9105-62/SM96224	2R+h	2	6,6
SM01120	BM9223-2/SM96275	2R+h	2	10,5
SM01160	SM96137/SM96003	6R+h	2,5	1,5
SM01163	SM96137/SM96003	6R+h	1,5	3,8
SM01171	Foster/BT456	6R+h	2	3,0
SM01279	BM9126-35/SM96481	2R+h	3	17,6
SM01285	BM9206-9/SM96617	2R+h	2	9,0
SM01313	SM96180/SM96184	2R+h	2	7,1
SM01367	SM96183/SM97030s	2R+h	3	10,6
	M94470/Hokkuiku 31//CDC			
SM01538s	Kendall	2R+h	2	8,3
SM01574	BM9120-33/SM96408	2R+h	2	1,8
SM01644	BM9223-2/SM96617	2R+h	2	3,8
SM01813	SM95091/SM96003	6R+h	2	11,9

In 2002, 8 of the lines selected for the 2003 crossing block showed lower DON.

Name	Pedigree	Type	Lodging	FHB Rating	DON (ppm)
AC					
Metcalfe		2R+h	1	2,5	6,5
CI4196		2R+h	4	1	5,1
SM02006	SM97092/SM97110	2R+h	2	2,5	4,6
SM02036	TR156/BM9304-4	2R+h	4	1	5,5
SM02119	SM98787/BM9203-74	2R+h	2	1,5	5,5
SM02129	TR160/HB335	2R-h	1	1,5	4,9
SM02134	TR160/HB335	2R-h	1	1,5	4,4
SM02160	M83/SM97292	6R+h	1	1,5	6,4
SM02322	SM97121/SM96253	2R+h	4	2	4,2
	CDC				
SM02339	Copeland/SM97030s	2R+h	1	1,5	5,4

Populations from these crossing blocks are still in early stages of development. Among the regular breeding program, it is however possible to select potential cultivars with fusarium tolerance level as good as the best commercial varieties in Canada.

BT 485 (SM99142, M82 / SM94021) is a white aleurone 6-row Malting Barley. In addition to improved agronomic characteristics and promising malting quality, this new line is showing fair tolerance, similar to CDC Sisler.

Year	Name	Head.	Lodg.	FHB Rating	DON (ppm)
1999	BT485	52	3	3	1,7
	CDC Sisler	53	7	-	-
2000	BT485	57	3	3	7,1
	CDC Sisler	62	5	2	3
2001	BT485	53	2	4	41,1
	CDC Sisler	55	3	3,4	19,2
2002	BT485	57	2	3	11,7
	CDC Sisler	58	2	2,8	11,5

TR01176 (SM00599, SM95152 / BM9014-10) and TR02185 (SM00599, SM95152 / BM9014-10) are two experimental 2-row Malting Barley lines tested in the 2002 Western Co-operative 2-Row Barley Registration Test and both showed FHB tolerance, similar or better than AC Metcalfe.

Year	Name	Head.	Lodg.	FHB Rating	DON (ppm)
2001	TR01176	65,7	4,7	3	24,9
	TR02185	65,5		3	9,7
	AC				
	Metcalfe	59,7	4,3	1,7	26,4
2002	TR01176	59	2	3,2	10,6
	TR02185	58	1,7	1,8	4,5
	AC				
	Metcalfe	57	2	2,5	6,5

Objective 5. *In vitro* selection (Supported specifically by ARDI funding)

Specifically supported by ARDI, *in vitro* selection (IVS) in conjunction with doubled haploid (DH) production has been explored as an instrument to generate or enhance new and existing sources of FHB resistance. *In vitro* selection was applied to three types of parental materials: current varieties (two- and six-row, covered and hulless), FHB resistance sources, and populations segregating for FHB resistance. Several methods have been applied to create the different IVS groups, including variation in the types of toxins applied to the selective growth media and the concentrations at which they were applied. In addition to DON, several other mycotoxins produced by *Fusarium* spp. such as 3-acetyl deoxynivalenol (ADON) and T2 were

employed in some experiments. Along with evaluating reactions to FHB, IVS lines have been assessed for their agronomic performance in yield trials. Several lines have also been assessed for malting quality.

Current varieties:

In vitro selection was applied to 13 varieties. Six-row varieties were Excel, Robust and MN Brite. Two-row varieties included: AC Metcalfe, Cheri, Manley, CDC Kendall, Rivers, AC Bountiful, AC Oxbow, CDC Stratus, TR253 and Newdale. While tested for FHB, these lines were also evaluated in yield tests and for malting quality.

Eleven *in vitro* selected (IVS) Excel DH lines were tested over three years, under varying degrees of replication. Although not significantly at $P = 0.05$, mean DON content of the IVS group was lower than the parental line over all three years. The interaction of entry by year was significant for DON content, indicating the difficulty in discerning best lines. Noteworthy are Excel 99/12-3 and Excel 99/18-2, which showed consistently lower mean DON levels than Excel over all three years. The overall reduction in DON vs. the Excel parent was 23 and 20%, respectively and approached that of AC Metcalfe. This could be a significant improvement in six-row malting barley.

Twenty-two *in vitro* selected Robust DH lines were tested over two years. Average DON levels for IVS lines were lower than the Robust parent in 2002, but not in 2001. RobustDT00-6 showed a 14% overall decrease in DON level when compared to Robust. RobustDT00-14 showed a similar reduction in DON, but results were more variable.

Six *in vitro* selected AC Metcalfe DHs were tested over three years. Two lines, AC Metcalfe 99/30-1 and AC Metcalfe 99/30-3, had significantly higher DON levels than AC Metcalfe over the three years. Although the Brandon FHB nursery indicated IVS lines generally do not show FHB resistance gain over AC Metcalfe, results from China are contradictory, where mean FHB reactions were less than AC Metcalfe.

Twenty-five *in vitro* selected, DH lines from Cheri, Manley, CDC Kendall and Rivers were also tested over two years. CheriDT0018-1 performed better with average DON content slightly less than Cheri. All IVS lines from Manley showed greater levels of DON than Manley. Perhaps most promising are the IVS CDC Kendall lines, which show a significant average decrease compared with CDC Kendall over both years. CDC KendallDT002-1 and CDC KendallDT002-4 look particularly promising with reductions in DON content of 33 and 44 %. The latter line also has lower DON content than AC Metcalfe. Several lines derived from Rivers (TR256) showed substantial improvements. In both years, 71% of these lines have shown lower DON content than their parent. Line TR256DT0016-5 shows good potential with an average significant decrease in DON content of 39 %. This line also did well in China. Although most lines generally showed decreased DON compared with Rivers, some high DON lines such as TR256DT0016-7 were present and most had a higher DON content than AC Metcalfe.

Seventeen *in vitro* selected DH lines from the following were evaluated in a single year: AC Bountiful, AC Oxbow, CDC Stratus, TR253, Newdale (TR258) and MNBrite. The majority of IVS lines tended to have similar to higher DON content than their parents. MNBriteDT002-4 had the lowest DON content in the test, and was the only line to have significantly lower DON

content than its parent.

Resistance sources:

In a second approach, *in vitro* selection was applied to genotypes with putative FHB resistance. Genotypes included: Chevron (5 IVS lines, 10 control DH lines), CI4196 (23 IVS lines, 23 control DH lines), Gobernadora (8 IVS lines), Harbin (15 IVS lines, 13 DH control lines), Svanhals (6 IVS lines) and Zhedar #1 (4 IVS lines, 39 DH control lines). Control lines produced through the same double haploid process without the addition of toxin to growth media were only included with the IVS lines in year 2002. DON data were not collected in 2002 for lines derived from Svanhals and Zhedar #1 due to their poor condition in that test from lodging and observed head abnormalities.

Chevron IVS lines have not shown improvement over their parent. Several CI4196 IVS lines such as CI4196DT0022-4, CI4196DT0026-1 and CI4196DT0026-2 had consistently lower DON levels compared with the parent and DH control lines. Gobernadora IVS lines have higher DON levels compared with their parent. Most Harbin IVS lines (particularly HarbinDT0010-5, HarbinDT0014-1 and HarbinDT0016-1) showed DON reduction relative to their parent and DH control lines. In 2001, all of the IVS Svanhals lines showed some reduction in DON concentration when measured against their parent with the exception of SvanhalsDT0016-1, which showed an abnormally elevated level (90.3 ppm vs. 18.9 ppm for Svanhals). Overall, *in vitro* selection appears to be less successful in lowering DON levels in the resistance sources group than the varietal group.

Segregating populations:

Finally, IVS was applied to populations segregating for FHB resistance as a selection tool to identify lines with improved tolerance. This included 14 crosses (9 crosses involving exotic resistance sources, e.g., Harbin, Svanhals, Chevron, CI4196 and Zhedar #1; 5 crosses of standard breeding material), with several other populations produced for future investigation.

IVS and control DH lines from crosses (Harbin/TR253/TR253 and Svanhals/AC Metcalfe/TR253) were replicated in the 2001 and 2002 FHB nurseries, 2001-02 FHB nursery in Hangzhou, China and in unreplicated yield tests in 2001 and 2002. No significant difference was found between the mean DON content of *in vitro* selected and control DH groups for either cross over both years. For the Svanhals cross, data collected from the China nursery actually demonstrated significantly lower mean visual FHB symptoms for the control lines vs. the IVS lines. Thus, *in vitro* selection did not appear to be effective in these two crosses.

Five crosses (Chevron/ CDC Fleet, CI4196/ CDC Fleet, Zhedar 1/ CDC Fleet, CI4196/ Manley, Zhedar 1/ Manley) of exotic resistance sources by Canadian two-row varieties were also subjected to *in vitro* selection. In 2001, lines from these crosses were grown in single rows. In 2002 we tested the material in two replicates, but performed DON analysis on composite samples. Corresponding parental lines were included with the lines from each cross for comparative purposes. No differences were found in mean DON content between the *in vitro* selected and control groups of 4 crosses (CI4196/CDC Fleet, Zhedar 1/CDC Fleet, CI4196/Manley and Zhedar 1/Manley). In 2001, cross Chevron/CDC Fleet showed a

significantly lower mean DON content in the *in vitro* selected group compared with the controls within the two-row sub-group. Conversely, in 2002 a significant increase in mean DON content was observed in the *in vitro* selected group over the controls within the six-row subgroup. More replication and testing over years is needed.

Two crosses (CI4196/ Excel and Zhedar #1/ Robust) of exotic resistance sources with recommended six-row malting varieties have also been subjected to *in vitro* selection. In 2001, lines from these crosses were grown in single rows with their parents. Lines from the Zhedar #1/ Robust cross were tested under replication in the 2002 nursery, with DON analysis on composite samples. No significant differences were observed between selected and control groups. Further testing will need to be performed on these crosses since many new IVS and control DH lines have been developed and increased over the past year.

The 5 standard crosses from the two-row malting barley program subjected to *in vitro* selection were tested for the first time in the 2002 nursery. Crosses Rivers/TR357, Rivers/Calder, Rivers/Rivers/SB93806 and CDC Copeland/Rivers were tested with two replications, whereas seed shortages restricted cross CDC Freedom/Rivers to being tested in single rows. For replicated material, DON content was tested on composite samples. For cross Rivers/Rivers/SB93806, a significant decrease in DON content was observed for the IVS group. This was the only breeding cross in which IVS was successful. For the hulless sub-group of cross CDC Freedom/Rivers, we observed a significant increase in DON content for the IVS lines vs. controls. For the covered sub-group, a significant decrease in FHB visual score was observed in the IVS group vs. controls, but DON content did not differ significantly for the two groups. Further testing will be required to confirm these results.

In vitro selection has also been applied to the following crosses: Chevron/AC Bacon, AC Metcalfe/ CDC Fleet and AC Bountiful/ CDC Bold. Both IVS and control groups have been developed from these crosses for future study.

Protocols:

Overall, the results of *in vitro* selection have been disappointing. Despite this the data provided by the FHB nursery at Brandon have identified several lines which hold promise for such a possibility.

One of the main reasons for using *in vitro* selection in varieties and resistance sources was to develop protocols for use as a selection tool in segregating populations. Early on, it was found that DON concentration of 5.7 ppm in anther culture was completely lethal so the range was refined. Genotype by DON concentration effects were large making protocol development more difficult. The best time to apply mycotoxin was at anther extraction.

Overall, the results suggest that the DON may work better alone than when used with other mycotoxins, and the concentration should range from 1 to 2 ppm.

Fine tuning of protocols, such as the concentration and composition of mycotoxins and length of exposure to the mycotoxins in culture, may improve the results. An experiment to that end has been initiated using Robust, Excel and AC Metcalfe. Since most of the work to date has been done in anther culture, changing to isolated microspore culture may also affect the results. *In vitro* selection using isolated microspore culture has been applied to one cross (AC Bountiful/

CDC Bold), but we do not have any results from the FHB nursery. Since the breeding program at Brandon has switched to isolated microspore culture for routine DH production, more testing of *in vitro* selection to improve FHB resistance will be conducted.

If successful, the use of *in vitro* selection as tool to routinely screen breeding lines for FHB would be invaluable. Mycotoxins could conveniently be added to growth media being used to recover embryos in a DH production system at little expense. Improvements in disease resistance within groups may be subtle, and may not be obvious after limited field evaluation. Additional testing will be required to evaluate the response of the *in vitro* selected populations. Whether *in vitro* selection is successful or not, lines identified with improved FHB resistance (from either IVS or control groups) will be advanced in the breeding program.

Objective 6. Population development

Initially, variable response to FHB reaction made determination of resistant and susceptible genotypes difficult. Several populations developed at AAFC Brandon at the beginning of the project study had to be dropped due to reclassification of parental reactions. DH populations for determining the inheritance of FHB resistance have since been produced as follows:

Cross #	Pedigree	# of 2x haps
BM9954D	CI4196 x Excel	204
BM9956D	Zhedar 1 x Robust	199
BM0106D	CDC Sisler x Stander	19
BM0236D	CI4196 x CDC Bold	249
BM0235D	AC Bountiful x CDC Bold	170
BM0238D	CDC Freedom x Tercel	137
BM0240D	AC Hawkeye x Jaeger	210
BM0237D	Zhedar 1 x CDC Bold	175

Additional funding for molecular marker research would be required to proceed with genetic studies on these populations and is beyond the mandate of the current project.

At the CDC several dozen crosses have been made specifically under the FHB objective as part of this project during 2000 through 2003. Many of these crosses have or will be handled in an accelerated fashion using doubled haploidy or our single seed descent programs to provide populations for genetic studies of FHB resistance and breeding materials for variety development. Unfortunately due to the need for significant quantities of seed for FHB evaluation in the Brandon FHB nursery none of these materials will be available for evaluation during the time frame of the current project. FHB resistant parents being used include CI4196, HDE 84194-622-1, 2ND16092 and local parents like CDC Freedom and TR361 which have been identified in this project.

7) Added Objective. Development of DON calibration for NIR

A new objective to develop a calibration for NIR to determine DON content was added to the project in 2001/02. NIR offers many advantages over current methods of measuring DON, including short analysis time, limited sample preparation and low cost. This research was conducted at the CDC, Saskatoon, using a FOSS NIR Systems 6500 Near Infrared Spectrophotometer. Initial calibrations were created using ground material from 577 samples grown in the FHB nurseries at Brandon and Ottawa in 2001 with DON content ranging from 0 to

161 ppm (as determined by the ELISA technique at ECORC). Correlation between predicted values and DON laboratory values was encouraging at 0.932.

To validate and improve the NIR calibration established from the 2001 samples, 335 ground and whole grain samples from the 2002 and 2003 Brandon FHB nurseries were used. The range in DON content of these samples was lower than in 2001 which may have been part of the reason that the correlation between predicted values and laboratory DON values was lower in 2002, ranging from 0.680 to 0.749.

NIR was also used to screen two F5 breeding populations (205 samples) from the 2002 Brandon FHB nursery for DON content. The correlation between NIR predicted and laboratory DON content at 0.62.

The accuracy of the equation in predicting DON levels, especially those below 10 ppm, will continually be improved by the addition of more samples consisting of different varieties grown at various locations and containing a wide range of DON values. By improving the accuracy of the calibration, the number of samples to be analyzed by ELISA can be reduced. If only one-quarter to one-half of the total number of samples remained for ELISA analyses, a considerable amount of time, effort and money would be saved. At this time NIRS allows the elimination of samples with very high DON levels.

An equation based on whole grain also shows promise, although more samples must be added to improve the correlations. This would eliminate grinding and make initial screening prior to ELISA significantly more efficient.

Posters on this aspect of the project have been presented in 2003 at the 3rd Canadian Barley Symposium, June 19 and 20 at Red Deer and at the 3rd Canadian FHB Workshop, Dec. 9–12 at Winnipeg.

D) PERSONNEL

Employed at Brandon:

Cameron Denbow - Tech Research Asst. - July 2001 – August 2001
Shannon Gerrard - Summer Student Asst. - July 2001 - September 2001
Donna Sagin - Summer Tech Research Asst. - July 2001 - September 2001
Blair Drader - Summer Tech Research Asst. - July 2001 - August 2001
Holly-Lee Lambert - Summer Tech Research Asst. - July 2001 - August 2001
Ryan Mossny - Tech Res Asst - September 2001 – October 2001
Elizabeth Gray - Tech Res Asst - October 2001 – December 2001
Dennis Shurvell - Summer Student Asst/Tech Res Asst - May 2002 – Oct 2002
Denise Immerkar - Summer Student Asst/ Tech Res Asst - May 2002 – Feb 2003
Antonia Van Meijl - Summer Student Asst/ Tech Res Asst - May 2002 – April 2003
Traci Geremia - Tech Res Asst - April 2003 – Sept 2003
Amy-Lynne Smith - Summer Student Asst - May 2003 – Sept 2003
Jennifer Kynoch - Tech Res Asst - October 2003 – Dec 2003.
Steven Myers - Tech Res Asst - October 2003 – Dec 2003

Employed at Saskatoon:

Doug Voth - Res Asst APG2 - part time July 2001 – Dec 2002

E) EQUIPMENT – None purchased.

F) PROJECT DEVELOPED MATERIALS – the following publications were produced during the project:

- 1) Legge, W. G. 2001. Update on the Barley FHB Project at the Brandon AAFC Research Centre. Page 96 in Proceedings of the 2nd Canadian Barley Symposium, Feb. 27-March 1, 2001, Saskatoon, Saskatchewan.
- 2) Legge, W.G., Therrien, M.C., Tucker, J., Tekauz, A., Sommers, D., Savard, M., Rossnagel, B.G., Lefol, E., Voth, D., Zatorski, T. B. L. Harvey, and Scoles, G. J. 2001. Improving FHB Resistance in Barley for Western Canada. Pages 21-24 in Proceedings of the Canadian Workshop on Fusarium Head Blight, November 3-5, 2001, Ottawa, Ontario.
<http://res2.agr.ca/ecorc/fusarium01/index.htm>
- 3) Tucker, J.R., Legge, W.G., Savard, M., Therrien, M.C., Tekauz, A., Rossnagel, B.G., Harvey, B.L., Lefol, E., Voth, D., and Zatorski, T. 2002. Reactions of barley cultivars to Fusarium head blight (*Fusarium graminearum*) in western Canada. Page 37 in Proceedings of the 17th North American Barley Researchers Workshop, September 22-25, 2002, Fargo, North Dakota, USA.
- 4) Banik, M., Legge, W.G., Bizimungu, B., Tucker, J., Therrien, M.C., Tekauz, A., Eudes, F., and Savard, M. 2002. Effectiveness of in vitro selection in barley for Fusarium head blight resistance. Page 20 in Proceedings of the 17th North American Barley Researchers Workshop, September 22-25, 2002, Fargo, North Dakota, USA. (Copy of abstract and poster attached in Appendix I).
- 5) Arganosa, G. C., Rossnagel, B. G., Legge, W. G., Savard, M. E., Zatorski, T., Voth, D. and Tucker, J. 2003. Prediction of deoxynivalenol (DON) in feed barley using near-infrared spectroscopy. Page 96 in Proceedings of the 3rd Canadian Barley Symposium, June 19-20, 2003, Red Deer, Alberta.
- 6) Legge, W.G., Therrien, M.C., Tucker, J., M. Banik, Tekauz, A., Sommers, D., Savard, M., Rossnagel, B.G., Lefol, E., Voth, D., Zatorski, T. B. L. Harvey, and Scoles, G. J. 2003. Progress in Breeding for FHB Resistance in Barley. Pages 73-80 in Proceedings of the 3rd Canadian Workshop on Fusarium Head Blight, December 9-12, 2003, Winnipeg, Manitoba.
- 7) Arganosa, G. C., Rossnagel, B. G., Legge, W. G., Savard, M. E., Zatorski, T., Voth, D. and Tucker, J. 2003. Prediction of deoxynivalenol (DON) in barley using near-infrared spectroscopy. Page 124, Proceedings of the 3rd Canadian Workshop on Fusarium Head Blight, December 9-12, 2003, Winnipeg, Manitoba.

G) PROJECT PHOTOS – None.

H) ACKNOWLEDGEMENT – support from SAF/ADF was recognized during all field and lab tours, in annual reports to ADF and ARDI, in all publications and during all media opportunities.

Table 1. Repeated Check Sets for 2000-2003 FHB Nursery at Brandon, MB.

Year	Check	Days to Heading ¹			Lodging ²			FHB Rating			DON (ppm)				
		Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	Min	Max
2000	AC Metcalfe	60.9	0.4	145	3.8	0.1	142	3.5	0.1	142	2.2	0.1	66	0.4	8.2
	CI4196	71.9	0.4	140	3.9	0.2	139	3.1	0.1	134	2.0	0.2	41	0.1	4.8
	Stander	54.2	0.3	145	2.4	0.1	142	4.3	0.1	142	8.3	0.4	67	0.6	23.8
	CDC Sisler	56.5	0.6	24	4.5	0.4	22	3.6	0.2	22	3.7	0.4	14	0.5	7.4
	Chevron	59.9	0.4	24	5.5	0.3	22	2.8	0.2	22	2.2	0.3	14	0.3	3.7
	Robust	55.4	0.5	24	3.8	0.3	22	4.0	0.2	22	4.7	0.5	14	2.0	8.8
2001	AC Metcalfe	57.9	0.5	85	5.0	0.2	74	3.0	0.1	85	29.3	1.9	44	6.9	58.4
	CI4196	65.7	1.0	85	5.6	0.2	71	2.5	0.1	85	22.3	2.3	41	2.1	58.4
	Stander	54.6	0.5	85	4.2	0.2	76	4.2	0.1	84	47.6	2.6	40	11.4	87.0
	Metcalfe	61.0	0.5	88	5.1	0.2	88	3.0	0.1	88	29.6	1.4	59	13.9	62.5
	Zhedar 1	61.5	0.5	88	5.7	0.2	88	2.5	0.1	88	25.8	1.2	59	9.7	51.4
	Stander	54.2	0.3	88	4.1	0.2	88	4.1	0.1	88	45.6	1.9	59	15.6	95.6
	CDC Sisler	56.8	0.4	70	4.3	0.2	63	3.6	0.1	70	26.4	1.6	44	10.9	68.0
	Chevron	59.6	0.4	70	5.7	0.2	42	1.9	0.1	70	22.6	1.9	43	6.5	72.0
	Robust	54.9	0.3	70	4.4	0.2	65	3.8	0.1	70	35.1	3.0	42	6.5	128.5
	CDC Stratus	64.0	0.7	69	5.2	0.2	70	3.1	0.1	70	26.1	1.6	45	10.6	67.9
	Harbin	59.0	1.0	70	5.5	0.2	70	2.2	0.1	70	20.7	1.0	45	11.9	37.0
	Excel	53.3	0.3	70	3.9	0.2	70	3.9	0.1	70	34.3	2.0	45	18.1	83.9
	AC Metcalfe	51.1	0.2	94	2.2	0.2	94	2.5	0.1	94	10.9	0.8	63	1.7	41.9
	CI4196	58.2	0.7	94	2.5	0.2	94	2.2	0.1	94	9.4	0.7	63	1.2	22.4
	Stander	47.5	0.2	94	1.1	0.0	94	3.6	0.1	94	18.4	1.2	45	5.8	40.9
2002	Metcalfe	53.0	0.3	80	2.5	0.2	80	2.5	0.1	80	14.0	1.0	45	3.9	28.7
	Zhedar 1	56.6	0.5	80	3.4	0.2	80	2.4	0.1	80	11.1	1.0	45	3.3	32.8
	Stander	47.9	0.3	79	1.3	0.1	79	3.7	0.1	79	19.1	0.9	44	8.3	31.2
	CDC Sisler	49.6	0.2	48	1.5	0.1	48	3.0	0.1	48	7.8	0.6	31	1.3	16.0
	Chevron	52.3	0.6	48	2.4	0.2	48	1.8	0.1	48	5.5	0.6	27	1.0	15.3
	Robust	48.0	0.2	48	1.5	0.1	48	3.5	0.1	48	10.9	0.8	30	5.1	21.4
	CDC Stratus	52.8	0.2	58	2.5	0.2	58	3.0	0.1	58	11.0	0.8	31	4.6	19.4
	Harbin	53.5	0.4	58	2.1	0.2	58	2.0	0.1	58	6.9	0.8	31	1.3	22.9
	Excel	48.0	0.3	58	1.5	0.1	58	3.4	0.1	58	13.5	1.0	31	4.6	26.9
	AC Metcalfe	52.9	0.3	62	-	-	-	2.8	0.1	62	12.5	0.6	31	4.6	20.1
	CI4196	59.6	0.3	62	-	-	-	1.9	0.1	62	6.3	0.7	31	2.3	20.1
	Stander	50.7	0.2	62	-	-	-	3.8	0.2	62	21.8	1.4	38	4.8	44.5
	Metcalfe	52.2	0.1	77	-	-	-	3.0	0.1	100	13.2	1.4	13	5.9	24.6
	Zhedar 1	56.0	0.2	77	-	-	-	1.6	0.1	100	6.9	0.8	13	3.1	10.8
	Stander	50.0	0.2	77	-	-	-	4.5	0.1	100	14.9	1.1	13	6.7	20.8
2003	AC Metcalfe	53.5	0.4	33	-	-	-	3.0	0.2	33	10.5	0.9	11	4.9	14.0
	CI4196	59.1	0.3	33	-	-	-	1.9	0.2	31	5.0	0.6	12	2.6	9.5
	CDC Bold	53.2	0.4	33	-	-	-	3.5	0.2	30	24.2	2.7	14	9.3	58.2
	CDC Sisler	51.7	0.2	39	-	-	-	3.1	0.1	44	11.8	0.9	15	5.9	21.7
	Chevron	52.6	0.2	39	-	-	-	1.6	0.2	44	7.9	0.9	15	3.5	16.0
	Robust	50.2	0.3	39	-	-	-	3.8	0.2	44	15.6	1.0	15	9.4	21.4
	CDC Sisler	53.1	0.5	7	-	-	-	2.8	0.3	7	6.6	0.2	2	6.4	6.8
	Chevron	55.7	0.5	7	-	-	-	1.2	0.1	7	5.2	0.3	2	4.9	5.5
	Stander	51.7	0.9	7	-	-	-	4.4	0.2	7	21.3	5.8	2	15.5	27.0
	CDC Stratus	52.8	0.2	55	-	-	-	3.5	0.1	75	12.7	1.0	12	7.5	19.6
	Harbin	53.7	0.2	55	-	-	-	1.8	0.1	75	6.2	0.6	12	3.6	9.7
	CDC Bold	51.9	0.1	55	-	-	-	4.2	0.1	75	21.6	1.6	12	15.4	30.9

¹ Note: 2002 & 2003 plots were rated as headed based on 50% spike emergence in a plot vs. 80% in previous years.² Note: Lodging statistics are not presented for 2003, as the majority of plots did not lodge in that year.

Table 2. Repeated Check Sets for 2000-2002 FHB Nursery at Hangzhou, China.

Year		Diseased Spikes (%)		Disease Index		Diseased Seeds (%)		n
		Mean	SE	Mean	SE	Mean	SE	
<u>2000-01</u>	AC Metcalfe	26.7	6.1	7.1	1.8	1.5	0.5	7
	CI4196	12.9	5.0	3.2	1.3	0.5	0.2	7
	Stander	76.5	8.4	26.3	4.2	5.4	0.7	7
	CDC Sisler	79.5	10.5	28.8	6.3	5.1	1.2	6
	Chevron	53.3	8.3	15.4	3.0	2.3	0.3	6
	Robust	83.4	10.0	32.1	4.7	5.6	1.3	6
	CDC Stratus	31.7	9.2	8.8	2.9	1.5	0.4	6
	Harbin	21.9	6.4	5.6	1.7	1.1	0.3	6
	Kasota	70.9	15.9	28.7	7.4	5.5	1.5	6
	AC Metcalfe	83.6	2.9	25.9	2.4	26.8	2.0	12
	CI 4196	5.1	1.3	1.4	0.4	1.8	0.4	12
	Stander	98.3	0.8	52.3	1.4	40.1	1.5	12
<u>2001-02</u>	CDC Sisler	92.2	2.7	46.5	5.3	32.0	2.3	12
	Chevron	86.8	2.6	32.4	3.0	25.9	1.4	12
	Robust	97.6	1.2	54.1	2.8	36.5	1.1	12
	CDC Stratus	69.5	1.7	18.6	1.3	21.4	1.3	12
	Zhedar 1	8.4	1.4	2.1	0.4	1.4	0.4	12
	Excel	94.8	2.0	53.1	2.0	43.5	1.2	12
	AC Metcalfe	60.7	5.9	16.8	1.6	6.6	1.0	10
	CI 4196	24.7	3.0	6.3	0.7	2.3	0.4	8
	Stander	85.8	3.9	35.6	2.3	20.0	3.0	10
	CDC Sisler	84.6	3.9	31.8	2.2	16.1	1.6	11
	Chevron	55.1	8.9	16.3	3.4	8.0	2.5	3
	Robust	88.0	4.0	36.3	2.5	21.1	1.8	11
<u>2002-03</u>	CDC Stratus	33.0	4.0	8.2	1.0	2.7	0.6	9
	Zhedar 1	22.2	3.4	5.6	0.9	1.5	0.3	9
	Excel	87.2	3.2	36.8	2.9	21.9	3.0	11

Table 3. Mean FHB rating and DON content for the 2000-2002 Western Cooperative Test Entries and Current Western Canadian Varieties by Row Type and Class.

Western Cooperative Test	FHB ratings					DON (ppm)		China-2000/01		
	2000	2001	2002	2003	2000	2001	2002	Diseased Spikes(%)	Disease Index	Diseased Seeds(%)
Six-row barley test	4.7±0.1	4.0±0.1	3.6±0.1	3.9±0.5	7.6±0.6	47.9±3.7	13.7±0.9	-	-	-
Two-row barley test	4.4±0.1	2.7±0.1	2.9±0.1	2.7±0.6	2.5±0.1	25.3±1.0	8.9±0.5	-	-	-
Hulless barley test (six-row entries)	4.8±0.1	3.7±0.3	4.0±0.4	**	8.3±0.1	32.4±7.0	14.7±2.8	-	-	-
Hulless barley test (two-row entries)	4.6±0.1	2.7±0.2	2.8±0.2	**	2.4±0.3	12.4±1.9	8.4±0.7	-	-	-
Variety FHB Test										
Six-row barley varieties	4.3±0.1	3.9±0.1	3.4±0.1	3.8±0.4	4.5±0.4	44.7±4.0	14.0±0.9	83.3±2.4	25.8±1.6	5.3±0.3
Two-row barley varieties	3.7±0.1	2.9±0.1	2.6±0.1	3.0±0.3	2.0±0.1	23.7±1.2	9.2±0.5	42.9±3.1	11.2±0.9	2.0±0.2
Six-row hulless varieties	4.3±0.3	4.0±0.3	3.8±0.3	3.9±0.4	5.2±1.7	33.8±7.3	18.5±4.5	76.7±6.3	23.5±2.4	3.9±0.6
Two-row hulless varieties	3.5±0.2	3.0±0.2	2.8±0.3	2.7±0.2	1.8±0.3	16.3±2.3	7.9±1.3	38.6±4.6	9.7±1.1	1.8±0.2

Where values = Mean ± Standard Error

* DON = Composite sample of 3 replicates, as measured by ELISA technique at ECORC, Ottawa.

A) Western Cooperative Six-row Barley Test

2000 Coop			2001 Coop			2002 Coop			2003 Coop			Registered Variety
	FHB	DON		FHB	DON		FHB	DON		FHB	DON	
CDC Sisler	4.0	2.7	CDC Sisler	3.2	24.8	CDC Sisler	2.8	11.5	CDC Sisler	2.2	12.2	
Excel	5.0	7.5	Excel	4.0	34.8	Excel	3.0	12.4	Excel	4.8	20.9	
AC Lacombe	4.7	5.3	AC Lacombe	4.3	53.5	AC Lacombe	4.5	19.0	AC Lacombe	4.2	25.2	
AC Rosser	5.0	6.1	AC Rosser	4.0	48.5	AC Rosser	4.3	10.8	AC Rosser	4.2	24.3	
BT010	5.0	6.7										
BT386	4.3	4.6										
BT477	5.0	6.3										
BT478	4.3	5.8										
BT958	5.0	5.7										
BT387	5.0	9.0										
BT388	4.7	5.6										
BT479	4.3	14.5										
BT480	4.7	10.9										
BT481	4.7	9.4										
BT482	4.7	8.5										
BT483	4.3	7.4	BT483	4.3	34.4							
BT484	5.0	12.9	BT484	5.0	72.5							
BT560	5.0	10.3	BT560	5.0	64.3							
BT561	5.0	5.2	BT561	4.0	38.8							
BT961	4.7	11.1										
BT962	4.7	6.0	BT962	3.2	29.5							
BT963	5.0	3.2										
BT964	5.0	12.2										
BT965	4.7	5.9	BT965	4.0	47.7							
			BT389	4.3	38.4							
			BT390	3.3	30.4							
			BT485	4.0	41.1	BT485	3.0	11.7				
			BT486	3.2	41.1							
			BT487	4.3	80.3							
			BT488	3.3	41.0							
			BT489	4.3	86.9							
			BT490	4.7	73.0	BT490	3.7	21.8				
			BT562	3.0	44.9	BT562	2.7	9.6				
			BT966	4.3	36.0	BT966	4.0	5.0				
			BT967	5.0	52.8							
			BT968	4.0	39.0							
						BT391	3.2	13.6				
						BT392	2.5	10.9				
						BT393	3.5	17.5				
						BT394	3.0	17.7				
						BT395	2.0	12.6				
						BT491	3.3	16.7				
						BT492	3.0	6.5				
						BT493	3.8	18.3	BT493	4.3	37.7	
						BT494	4.2	20.6				
						BT495	3.5	18.7	BT495	3.3	27.3	
						BT496	3.5	11.4				
						BT563	3.7	10.0	BT563	3.3	18.3	
						BT564	3.7	12.7				
						BT565	3.7	12.2	BT565	3.8	25.2	
						BT969	3.7	17.2				
						BT970	3.0	15.2	BT970	3.7	22.0	
						BT971	2.5	10.1				
									BT396	4.3	21.6	
									BT397	4.3	24.3	
									BT398	4.3	22.9	
									BT399	5.0	23.7	
									SR300	3.0	18.4	
									SR301	4.3	18.5	
									BT497	2.8	12.6	
									BT498	3.3	22.0	
									BT499	3.7	14.9	
									SR400	3.7	19.7	
									SR401	4.0	23.3	
									SR402	4.3	22.1	
									BT566	4.7	28.4	
									BT567	5.0	32.2	
									BT972	4.0	13.1	
									BT973	3.0	9.0	
Grand Mean	4.7	7.6		4.0	47.9		3.6	13.7		3.9	21.6	

B) Western Cooperative Two-row Barley Test

	2000 Coop			2001 Coop			2002 Coop			2003 Coop		Registered Variety
	FHB	DON		FHB	DON		FHB	DON		FHB	DON	
Harrington	4.7	1.1	Harrington	2.3	15.9	Harrington	2.8	7.7	Harrington	2.3	6.4	
Manley	4.0	2.0	-	-	-	-	-	-	-	-	-	
CDC Dolly	5.0	2.4	CDC Dolly	3.0	23.8	CDC Dolly	4.2	4.8	CDC Dolly	2.5	10.3	
AC Metcalfe	4.3	2.8	AC Metcalfe	1.7	26.4	AC Metcalfe	2.0	10.4	AC Metcalfe	2.2	11.1	
TR133	4.3	3.9	CDC Kendall	2.3	22.7	CDC Kendall	2.2	11.0	CDC Kendall	2.7	9.9	
TR166	3.3	2.1										CDC Goodale
TR167	4.0	1.8										
TR262	4.0	2.7										Calder
TR353	4.7	2.4										
TR706	5.0	3.2										
TR988	5.0	3.9										
TR989	4.7	2.3										
TR169	4.0	2.1	TR169	2.7	21.4							
TR170	3.7	3.1										
TR171	4.0	2.3	TR171	3.2	22.4							
TR172	4.7	2.7										
TR173	4.7	2.6										
TR174	3.7	1.6										
TR263	4.7	3.3										
TR264	4.0	3.2										
TR355	3.7	2.0	TR355	3.0	34.2							
TR356	4.7	2.3										
TR357	4.0	2.8	TR357	1.3	24.7							
TR358	4.3	2.8										
TR359	4.7	2.3	TR359	2.7	37.5							CDC Trey
TR360	3.3	3.9										
TR361	3.7	1.5	TR361	2.0	18.5							
TR649	4.7	1.8	TR649	2.3	23.1							
TR650	4.3	1.2										
TR651	5.0	1.9	TR651	3.3	38.2							Niobe
TR652	4.7	2.0										
TR653	5.0	2.5										
TR708	4.7	2.2										
TR709	4.7	4.0										
TR710	4.3	2.0	TR710	3.3	39.4	TR710	2.2	6.7				registered but i
TR992	5.0	2.3	TR992	2.7	27.9							
TR993	5.0	4.4										
TR994	5.0	3.0										
			TR01175	3.3	40.5							
			TR01176	3.0	24.9	TR01176	3.2	10.6				
			TR01177	2.7	29.9							
			TR01178	2.3	23.7	TR01178	2.7	6.2				
			TR01179	2.3	27.0							
			TR01180	2.3	22.6							
			TR01265	2.3	25.5							
			TR01266	2.3	23.9							
			TR01362	3.2	26.3	TR01362	2.3	8.6				
			TR01363	2.7	36.4							
			TR01364	3.3	32.9	TR01364	3.7	6.2				
			TR01365	2.3	26.0							
			TR01366	2.3	16.1							
			TR01588	1.7	22.2							
			TR01589	2.7	21.2							
			TR01654	2.8	25.4							
			TR01655	2.0	12.1	TR01655	3.3	5.1				
			TR01656	2.3	19.8	TR01656	2.5	7.5				Ponoka
			TR01657	2.7	13.9	TR01657	2.3	6.8				
			TR01658	2.7	24.4	TR01658	2.2	5.7				
			TR01711	3.0	12.6	TR01711	1.8	5.4				
			TR01712	3.3	18.6							
			TR01713	3.3	32.6	TR01713	2.7	9.6				
			TR01714	3.0	29.0							

TR01715	2.7	27.7	TR01715	3.3	9.0		
TR01716	2.3	21.8					
TR01995	2.7	18.7					
TR01996	3.7	30.4	TR01996	3.2	8.5		
TR01997	2.7	21.2					
TR01998	3.7	29.9	TR01998	2.8	7.7		
TR01999	3.0	20.2	TR01999	2.8	7.8		
TR01900	3.2	29.1					
			TR02970	2.5	9.2		
			TR02181	2.3	11.9	TR02181	2.7 10.4
			TR02182	2.3	8.7		
			TR02183	2.3	9.4		
			TR02184	2.0	8.5		
			TR02185	1.8	4.5	TR02185	1.2 5.2
			TR02186	2.5	12.0		
			TR02267	2.3	14.9		
			TR02268	2.8	11.4		
			TR02269	2.5	16.5		
			TR02270	2.8	11.0		
			TR02271	2.7	11.7		
			TR02272	2.5	11.7		
			TR02367	3.2	15.3	TR02367	3.2 17.9
			TR02368	3.5	12.1	TR02368	2.7 15.3
			TR02369	2.0	6.3		
			TR02370	3.0	6.0		
			TR02371	2.7	15.4	TR02371	3.0 12.9
			TR02590	2.5	5.9		
			TR02591	3.3	17.0		
			TR02659	2.7	4.8		
			TR02660	3.5	6.9		
			TR02717	2.5	5.5		
			TR02901	3.3	6.9		
			TR02902	1.7	13.7		
						TR03187	2.5 13.1
						TR03188	3.0 6.8
						TR03189	2.7 8.2
						TR03190	2.2 11.4
						TR03191	3.2 19.4
						TR03192	3.8 20.9
						TR03273	1.7 15.2
						TR03274	2.2 16.5
						TR03275	2.2 14.7
						TR03276	1.3 7.2
						TR03277	2.8 14.1
						TR03278	2.0 13.8
						TR03372	3.5 17.4
						TR03373	3.7 14.1
						TR03374	2.5 13.9
						TR03375	3.0 8.8
						TR03376	2.8 9.9
						TR03661	2.8 11.7
						TR03662	2.5 8.6
						TR03663	1.8 6.5
						TR03664	2.3 12.4
						TR03718	3.3 16.9
						TR03903	4.5 19.3
						TR03904	2.3 8.2
						TR03905	4.0 15.1
						TR03906	3.5 10.0
						TR03907	3.7 14.8

Grand Mean	4.4	2.5	2.7	25.3	2.9	8.9	2.7	12.5
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Row Type	2000 Coop		2001 Coop		2002 Coop		2003 Coop				
	FHB	DON	FHB	DON	FHB	DON	FHB	DON			
2 CDC Dolly	4.0	2.1	CDC Dolly	3.0	21.4	CDC Dolly	2.5	8.3	CDC Dolly	3.0	9.0
6 AC Bacon	4.7	1.8	AC Bacon	3.7	18.3	AC Bacon	3.0	3.8	AC Bacon	3.0	4.4
2 CDC McGwire	4.7	5.6	CDC McGwire	3.0	12.2	CDC McGwire	3.8	8.7	CDC McGwire	1.8	8.2
2 CDC Candle	4.3	1.1	CDC Candle	2.0	9.7	CDC Candle	2.7	3.3	CDC Candle	1.5	2.5
6 Falcon	5.0	10.6	Falcon	4.3	48.2	Falcon	4.7	15.5	Falcon	4.3	24.1
2 HB347	3.7	1.2									
2 HB348	5.0	2.0									
6 HB509	5.0	14.0									
2 HB352	4.7	1.5									
2 HB353	4.0	2.0									
2 HB355	4.0	2.5									
2 HB356	4.7	2.3									
2 HB109	4.3	2.6	HB109	3.3	17.5						
6 HB110	4.3	4.6									
6 HB358	4.7	10.6									
2 HB359	5.0	1.3	HB359	3.3	18.6						
2 HB360	5.0	1.8									
6 HB511	5.0	12.0	HB511	5.0	75.6						
6 HB512	5.0	8.5									
6 HB513	4.3	4.1	HB513	4.0	35.3						
2 HB808	5.0	3.2	HB808	2.7	15.3						
2 HB809	4.7	2.1	HB809	2.0	10.6						
2 HB810	5.0	4.5									
6			HB111	3.0	16.3						
6			HB112	2.7	18.3						
6			HB113	2.7	10.8						
2			HB361	2.7	7.0						
2			HB362	2.0	8.0	HB362	2.5	7.3			
2			HB363	2.0	5.8						
2			HB364	2.0	7.8	HB364	2.0	7.0			
2			HB365	2.3	9.1						
2			HB366	3.0	9.3						
2			HB367	3.7	34.5						
6			HB514	3.2	23.5	HB514	5.0	21.2			
6			HB515	4.7	45.3	HB515	4.2	26.0			
2			HB613	3.3	7.7						
2			HB904	2.5	12.7						
6						HB114	2.0	9.8			
2						HB368	2.3	5.3			
2						HB369	3.0	10.9			
2						HB370	1.7	7.9			
2						HB371	3.0	8.1	HB371	2.0	6.8
2						HB372	2.8	13.6			
2						HB373	3.0	10.7			
6											

D) Western Cooperative Forage Barley Test

Row Type	2002 Coop		2003 Coop	
	Row Type	FHB DON	FHB DON	FHB DON
6	Viriden	3.7 20.9	Viriden	4.5 18.5
6	Westford	4.7 28.2	Westford	5.0 36.2
6	AC Ranger	3.8 11.4	AC Ranger	4.0 18.0
6	AC Lacombe	3.8 12.8	AC Lacombe	3.8 19.8
6	Vivar	5.0 11.4	Vivar	5.0 17.1
6	FB001	4.7 22.2		
6	FB002	3.0 13.6		
6	FB003	3.2 15.5		
6	FB004	4.3 12.8		
6	FB005	2.8 8.4		
6	FB006	3.2 13.7	FB006	3.2 14.8
6	FB007	3.2 9.9		
2	FB201	2.5 5.8	FB201	1.3 8.8
2	FB202	2.8 7.0		
6	FB301	3.0 14.3	FB301	2.3 11.0
6	FB302	3.3 8.5	FB302	5.0 11.3
6	FB303	3.5 13.5		
6	FB304	4.8 38.2	FB304	5.0 64.0
6	FB401	3.5 8.4	FB401	4.8 16.5
2	FB402	1.8 4.1		
2	FB403	3.3 10.2	FB403	4.0 21.3
	FB203	3.0 2.8		
	FB404	4.3 10.0		
	FB405	4.7 5.4		
	FB406	5.0 6.9		
	Grand Mean	3.7 13.8		4.1 17.7

E) Eastern Prairie Barley Test

CDC Sister	Row Type	2000 Test		Row Type	2000 Test		Row Type	2001 Test		Row Type	2002 Test		Row Type	2003 Test	
		FHB	DON		FHB	DON		FHB	DON		FHB	DON		FHB	DON
AC Metcalfe	6	5.0	6.1	6	5.0	6.1	CDC Sister	6	3.8	22.5	2.5	7.5	6	2.2	9.9
BM9413-11	2	3.7	4.2	2	3.7	4.2	AC Metcalfe	2	2.8	31.7	2.2	10.5	2	2.3	8.9
BM9429D-3	2	3.3	3.0	2	3.3	3.0	BM9542-155	2	3.0	23.7	2.5	10.1	2	2.7	14.3
BM9429-11	2	3.3	3.1	2	3.3	3.1	BM9645-12	2	2.3	22.7	2.7	6.5	2	3.3	8.2
BM9429-2	2	3.7	2.8	2	3.7	2.8	BM9647D-43	2	2.7	23.5	2.3	8.0	2	2.3	12.5
BM9432-19	2	4.0	2.0	2	4.0	2.0	BM9647D-56	2	2.7	11.6	3.5	9.4	2	2.8	6.5
LM246-167	2	4.7	1.3	2	4.7	1.3	BM9647D-66	2	2.7	36.2	2.5	15.8	2	2.8	12.1
LM249-001	2	4.7	2.3	2	4.7	2.3	BM9647D-77	2	2.7	33.7	2.7	12.3	2	3.7	13.4
LM249-127	2	4.3	3.2	2	4.3	3.2	BM9651D-7	2	2.7	26.9	1.7	9.4	2	3.5	9.1
EX513-9	2	5.0	2.3	2	5.0	2.3	OBS4065-110	6	3.7	36.8	2.3	11.5	2	3.2	7.0
D18-24	2	4.7	2.2	2	4.7	2.2	OBS4065-127	6	3.7	35.8	3.2	7.1	2	3.2	6.7
OBS4985-1	6	4.7	9.8	6	4.7	9.8	OBS4065-157	6	3.5	31.8	3.0	13.2	6	3.7	8.5
SB98318	6	5.0	4.1	6	5.0	4.1	AB183-4	6	3.7	34.4	2.5	12.8	6	2.5	7.9
SB98098	2	4.0	2.7	2	4.0	2.7	EX517-10	2	3.0	33.0	3.5	13.7	6	4.0	4.6

SB98466	2	4.0	4.4	2	4.0	4.4	EX522-14	6	3.3	35.7	SB00688	2	2.7	7.5	SB01465	3.3	8.6
SB98134	2	4.3	4.1	2	4.3	4.1	EX524-3	6	3.2	36.4	SB00364	2	3.0	6.4	SB01178	1.8	11.3
SH98267	2	4.7	2.7	2	4.7	2.7	SH99119	6, hullless	4.7	16.0	SB00471	2	2.0	7.4	SB01513	1.7	8.0
SH98326	2, hullless	4.3	2.0	2, hullless	4.3	2.0	SH99643	2, hullless	2.5	10.2	SH99616	2, hullless	2.3	4.6	SB01060	3.0	18.4
SH98606	2, hullless	5.0	1.0	2, hullless	5.0	1.0	SH99654	2, hullless	2.7	6.7	SH00251	2, hullless	1.8	3.2	SB01125	2.8	16.2
SH98564	6, hullless	4.7	1.0	6, hullless	4.7	1.0	SB99095	2	3.0	22.6	SR00005	2, hullless	3.8	15.2	SB01385	1.7	15.5
SH98067	6, hullless	4.7	1.6	6, hullless	4.7	1.6	SB99252	2	3.0	35.8	SH00238	2, hullless	2.7	10.6	SB01522	2.2	11.1
SM98005	2	3.7	3.2	2	3.7	3.2	SB99279	2	2.0	22.2	MC9813-22	2, hullless	3.0	13.0	SB01675	5.0	21.1
SM98618	2	3.7	1.6	2	3.7	1.6	SB99637	2	2.0	17.0	SM00117	2	2.5	9.5	SM01111	1.8	9.0
SM98570	2	3.0	1.8	2	3.0	1.8	SM99103	2	2.0	21.4	SM00124	2	3.0	12.2	SM01422	2.5	12.8
SM98145	2	3.7	2.6	2	3.7	2.6	SM99614	2	3.3	22.0	SM00601	2	2.3	9.9	SM01448	2.8	11.1
SM98344s	2	4.3	5.8	2	4.3	5.8	SM99703	2	2.7	19.4	SM00047	2	3.0	7.7	SM01560	3.0	8.3
SM99439s	2	4.0	6.1	2	4.0	6.1	SM99310	2	2.7	24.6	SM00537	2	2.0	8.1	SM01645	2.7	15.0
SM98194	2	4.7	1.2	2	4.7	1.2	SM99542	2	3.7	33.3	SM00096	2	2.0	7.5	SM01581	4.2	15.2
SM99223	6	5.0	15.1	6	5.0	15.1	SM99441	2	2.2	17.5	SM00550	2	2.2	11.9	SM01363s	2.2	12.0
Grand Mean	6	5.0	15.3	6	5.0	15.3	SM99680	2	3.7	23.9	SM00334	2	2.3	12.6	SM01710s	3.3	16.0
		4.3	4.0		4.3	4.0			3.0	25.6			2.8	9.8		2.9	11.3

F) Mississippi Valley Barley Test

2000 Test			2001 Test			2002 Test			2003 Test		
	FHB	DON		FHB	DON		FHB	DON		FHB	DON
Barbless	4.7	7.2	Barbless	3.7	35.8	Barbless	2.7	7.9	Barbless	4.7	14.5
Larker	4.3	3.3	Larker	3.7	29.4	Larker	2.8	4.3			
Morex	4.3	5.4	Morex	3.0	22.6	Morex	3.0	5.5	Morex	2.2	10.7
Robust	4.3	7.4	Robust	4.0	41.3	Robust	3.2	12.6	Robust	2.7	16.4
Stander	4.3	10.6	Stander	4.7	45.7	Stander	3.2	22.3			
Foster	4.3	5.9	Foster	2.8	32.7		-	-			
Legacy	4.3	5.5	Legacy	3.7	31.4	Legacy	3.3	12.9	Legacy	3.6	15.3
MNBrite	4.7	8.1	MNBrite	2.7	32.7	MNBrite	1.8	8.9			
Drummond	4.7	4.4	Drummond	3.7	51.2	Drummond	3.5	14.3	Drummond	2.5	17.1
Lacey	4.7	8.4	Lacey	3.7	25.0	Lacey	3.7	11.6	Lacey	2.5	18.3
									Conion	2.7	7.4
									Tradition	3.2	17.1
6B94-8253	4.3	7.6									
M103	5.0	8.5	M103	2.8	42.6						
M104	4.3	8.4									
ND16301	4.7	8.0	ND16301	3.7	35.1	ND16301	3.0	9.4			
2ND16461	4.7	1.1									
6B95-2482	4.3	13.0	6B95-2482	4.0	45.1	6B95-2482	3.8	15.3			
6B96-3733	4.0	9.0	6B96-3733	3.7	49.4	6B95-2089	3.7	11.4			
BT462	4.7	5.6									
M106	5.0	10.0	M106	4.0	63.1						
M107	4.3	11.9									
M108	5.0	9.9	M108	4.0	52.9						
ND15422	5.0	8.7									
ND17-79	4.3	5.6									
ND17082	4.0	7.4									
ND17190	4.7	10.7									
2ND17275	4.0	2.4									
6B95-2089	5.0	10.9	6B95-2089	4.0	36.9						
6B96-3373	4.7	9.7									
BT470	4.7	8.4									
BT478	4.0	7.2									
			M109	4.0	38.0	M109	4.0	15.2	M109	3.7	13.3
			M110	4.0	41.5	M110	3.5	13.5			
			ND16318	2.5	44.4						
			ND16803	3.0	39.9						
			ND16922	4.3	39.4	ND16922	3.0	11.4			
			6B97-2037	3.3	32.4						
			6B97-2195	3.3	42.4						
			6B97-2245	4.7	48.6						
			BT386	3.3	36.5						
			BT484	4.0	47.6						
			Battleford	3.7	31.7						
						M111	3.7	12.1			
						M112	3.0	9.6	M112	3.3	14.3
						M113	3.8	18.9			
						ND17643	2.7	9.5	ND17643	3.0	20.0
						ND17655	2.0	10.6	ND17655	3.0	18.8
						ND17687	3.7	7.9			
						ND17711	3.3	7.1	ND17711	2.5	12.0
						2ND18365	3.2	8.1			
						6B98-9105	3.7	7.7			
						6B98-9170	3.3	7.9	6B98-9170	3.8	17.9
						6B98-9339	3.0	9.4	6B98-9339	4.8	30.2
						BT389	3.7	15.6			
						BT478	3.2	11.7			
						BT483	2.7	11.5			
									M115	2.8	17.8
									M116	3.0	26.8
									M117	3.3	12.4
									ND18578	3.5	18.9
									ND18579	3.7	27.8
									ND18850	2.3	16.4
									2ND19098	2.0	10.4
									2ND19119	2.3	14.1
									2ND19929	2.3	17.9
									6B99-6339	3.7	25.5
									6B99-6639	4.2	19.0
									6B99-6774	3.8	33.5
									Newdale	3.5	13.8
									BT485	3.3	16.3
									BT490	4.3	25.2
Grand Mean	4.5	7.7		3.6	39.8		3.5	11.1		3.2	18.0

Note: Lines are six-row barley unless otherwise specified with an ***

Table 5. Fusarium Head Blight Reactions of Western Canadian Varieties tested at Brandon, MB and Hangzhou, China between 2000-2002.

Cultivar	Row	Type ⁴	FHB ratings				DON (ppm) ¹				China 2000/01			2003 Prov. Seed Guide Ratings ²	2002 Spot Blotch Rating ³	
			2000	2001	2002	2003	2000	2001	2002	2003*	Diseased Spikes(%)	Disease Index	Diseased Seeds(%)		Spot 1	Spot 2
AC Metcalfe	2	check	2.3±0.3	2.5±0.3	2.3±0.3	2.5±0.3	1.7±0.1	24.2±3.2	14.9±3.0	11.9±0.6	33.3	9.2	2.0			
CI 4196	2	check	1.7±0.3	1.3±0.3	1.7±0.3	1.0±0.0	1.9±1.2	7.8±3.2	9.6±2.8	3.8±0.1	20.0	5.0	0.7			
Stander	6	check	4.3±0.3	5.0±0.0	3.3±0.3	5.0±0.0	4.0±0.9	57.1±2.8	18.4±4.4	20.9±2.6	100.0	26.7	4.1			
CDC Sister	6	check	3.7±0.3	3.0±0.0	3.0±0.6	2.0±0.0	3.2±0.4	21.6±4.3	8.4±1.4	11.2±0.7	90.0	39.2	6.5			
Chevron	6	check	1.7±0.3	1.0±0.0	1.8±0.2	0.7±0.2	1.9±0.4	15.8±3.2	4.8±0.6	6.5±0.9	53.3	13.3	2.5			
Robust	6	check	4.0±0.0	4.0±0.0	3.0±0.0	4.2±0.2	3.7±1.1	29.6±6.0	11.4±0.7	16.6±0.3	100.0	37.5	9.2			
AC Albright	6	F	4.3	4.3	3.2	4.0	2.2	21.1	10.3	16.2	90.0	40.8	3.8	-	2.0	2.5
AC Bacon	6	H	4.0	3.3	3.3	2.3	0.8	11.8	7.8	5.9	80.0	27.5	3.1	F	4.5	6.0
AC Bountiful	2	M	2.3	2.0	1.8	2.0	1.2	13.4	11.4	14.0	30.0	7.5	1.1	F+	3.0	5.5
AC Buffalo	6	M	3.7	4.0	2.7	-	2.5	39.1	11.2	-	70.0	25.8	4.8	-	3.5	4.0
AC Harper	6	F	5.0	4.3	4.5	5.0	3.6	55.1	21.3	20.4	80.0	17.5	3.8	VP	3.5	4.0
AC Hawkeye	6	H	3.0	2.7	2.7	1.5	1.2	7.9	8.2	2.6	83.3	28.3	6.0	F	3.5	6.0
AC Kings	2	F	3.7	2.7	2.0	-	1.3	24.4	8.0	-	43.3	11.7	1.6	-	4.5	5.5
AC Lacombe	6	F	4.7	4.0	3.7	4.5	4.7	55.4	17.6	17.4	100.0	47.5	9.8	VP	3.5	4.5
AC Metcalfe	2	M	3.0	2.3	2.5	3.0	2.2	22.7	14.0	14.4	33.3	8.3	1.4	F	4.0	5.0
AC Oxbow	2	M	3.0	2.3	2.5	1.7	1.3	18.2	14.0	9.2	40.0	10.0	1.2	F	3.0	5.5
AC Queens	2	F	2.7	3.0	2.3	2.7	2.2	24.8	11.1	8.4	53.3	19.2	2.3	F	4.0	6.5
AC Ranger	6	F	4.0	3.8	3.7	5.0	5.7	43.2	17.5	17.2	70.0	22.5	5.0	VP	3.0	4.0
AC Rosser	6	F	4.3	4.7	3.3	4.5	3.3	39.0	15.9	18.2	66.7	20.0	4.7	VP	3.0	3.5
Argyle	6	M	3.0	2.8	2.3	1.7	2.0	15.4	8.4	8.0	96.7	62.5	8.2	F	2.0	2.0
B1215	2	M	4.0	3.3	3.7	-	2.3	31.7	10.5	-	10.0	2.5	0.4	-	4.5	6.0
B1602	6	M	3.7	3.8	2.8	4.3	2.4	39.0	11.5	21.7	96.7	24.2	7.0	P	1.5	2.5
Bedford	6	F	4.3	3.0	2.7	4.0	1.5	21.5	10.5	12.1	86.7	24.2	6.8	F	3.0	3.5
Bridge	2	F	4.0	3.3	2.0	3.0	1.8	21.0	9.8	11.7	63.3	15.8	2.7	F	3.0	6.0
Brier	6	F	4.3	3.2	3.0	3.7	3.6	50.7	10.5	22.5	66.7	16.7	4.8	P	4.5	5.0
Bronco	6	F	3.7	2.7	2.8	3.0	1.9	21.9	9.9	12.1	-	-	-	F	4.0	5.0
BT483 = Brier?	6	M	4.3	4.3	2.8	-	7.4	34.4	19.8	-	-	-	-	VP	2.0	2.5
BT954	6	M	4.7	2.7	2.8	-	5.1	42.3	13.6	-	86.7	21.7	6.2	VP	2.5	3.0
BT485	6	-	-	-	-	4.0	-	-	-	14.7	-	-	-	-	-	-
BT490	6	-	-	-	-	4.3	-	-	-	23.3	-	-	-	-	-	-
BT966	6	-	-	-	-	3.3	-	-	-	14.2	-	-	-	-	-	-
Calder	2	M	-	2.3	2.2	2.0	-	17.0	6.0	10.6	-	-	-	F	3.0	4.5
CDC Alamo	2	H	4.0	3.7	4.0	4.3	1.6	27.3	19.9	13.6	46.7	11.7	2.0	-	6.5	8.5
CDC Battelford	6	M	3.7	3.7	2.7	4.7	4.2	26.1	13.1	21.2	63.3	15.8	4.5	P	1.0	2.0
CDC Bold	2	F	4.7	3.7	2.5	4.7	3.3	43.2	16.1	28.7	50.0	12.5	2.0	P	5.0	7.5
CDC Buck	6	H	-	4.3	4.2	-	-	28.0	17.7	-	-	-	-	-	2.0	2.0
CDC Gandle	2	H	4.3	2.0	2.2	1.2	1.2	9.4	4.0	3.0	30.0	7.5	1.0	-	5.5	8.5
CDC Copeland	2	M	3.7	3.0	2.8	2.8	1.0	17.3	8.3	10.4	36.7	9.2	1.6	F+	6.0	9.0
CDC Dawn	2	H	3.7	2.7	2.2	2.7	1.9	10.5	5.3	7.1	20.0	5.0	1.1	F+	2.0	6.5
CDC Dolly	2	F	2.7	2.7	3.2	2.5	1.3	23.5	5.7	13.6	40.0	10.0	2.0	F+	5.0	8.0
CDC Earl	6	F	5.0	4.7	4.0	5.0	8.4	102.7	29.1	41.3	46.7	11.7	2.4	VP	5.0	5.5
CDC Fleet	2	F	4.7	4.0	1.7	3.5	1.6	20.7	5.3	6.0	16.7	4.2	0.7	F+	6.0	8.0
CDC Freedom	2	H	2.3	2.3	2.7	1.0	0.9	11.8	7.8	4.2	30.0	7.5	1.5	F+	3.5	6.0
CDC Garner	2	H	4.3	3.7	2.5	3.7	1.0	17.0	6.3	7.2	70.0	17.5	3.0	F	6.0	9.0
CDC Goodale	2	M	3.9	2.3	1.7	2.5	2.1	29.7	9.0	11.8	-	-	-	F	2.5	3.0
CDC Guardian	2	F	5.0	2.7	3.7	-	1.4	11.8	7.6	-	60.0	15.0	2.8	-	7.5	9.0
CDC Helgason	2	F	3.0	3.0	2.8	4.5	4.2	27.5	14.6	18.3	56.7	14.2	5.4	P	4.5	6.0
CDC Kendall	2	M	3.7	3.0	2.7	3.7	1.4	17.6	12.5	12.0	50.0	12.5	2.5	F	5.5	8.0
CDC McGwire	2	H	3.3	3.0	4.0	1.5	3.8	14.1	10.5	6.5	23.3	5.8	1.0	F	4.0	6.5
CDC Select	2	M	3.0	3.0	3.0	3.5	4.8	31.5	12.8	14.9	36.7	10.0	1.7	P	4.5	5.5
CDC Silky	6	H	4.0	3.3	3.3	4.7	4.7	31.3	16.3	18.9	46.7	12.5	2.5	P	3.5	4.5
CDC Sister	6	M	3.3	3.8	2.8	2.2	2.0	24.9	7.3	17.4	83.3	29.2	5.6	F	1.5	2.5
CDC Speedy	2	H	2.7	2.7	2.0	3.0	1.6	11.8	3.0	4.1	39.1	9.8	1.9	-	3.0	3.0
CDC Springside	6	M	4.0	3.3	3.0	3.0	7.2	40.0	13.3	19.5	-	-	-	VP	1.5	1.5
CDC Stratus	2	M	4.0	3.3	2.8	3.8	1.7	28.8	11.5	13.0	43.3	10.8	2.0	F	4.5	6.0
CDC Thompson	2	M	4.3	3.5	3.5	4.5	2.6	30.2	7.2	9.4	20.0	5.0	0.9	F	6.0	6.0
CDC Tisdale	6	M	3.7	3.7	2.7	3.5	3.7	40.2	10.1	14.4	80.0	24.2	6.4	VP	2.0	3.0
CDC Trey	2	F	4.7	2.7	2.6	2.8	2.3	37.5	7.7	10.6	-	-	-	F	5.5	7.5
CDC Unity	2	M	3.3	2.8	2.5	2.5	1.3	24.3	5.6	7.4	63.3	11.7	2.5	-	3.5	5.0
CDC Yorkton	6	M	4.3	2.8	3.0	3.7	2.5	32.3	11.0	14.0	83.3	22.5	1.9	P	2.5	3.0
Condor	2	H	3.0	2.7	1.7	2.2	1.1	11.5	5.6	6.8	36.7	10.0	1.4	F+	5.0	6.0
Conlon	2	M	3.0	2.0	2.0	2.2	1.2	19.3	3.3	6.3	83.3	24.2	3.3	F+	4.5	4.0
Deuce	2	F	3.7	2.7	2.3	3.2	1.1	20.7	5.5	10.3	66.7	20.0	2.1	F+	6.0	8.0
Dillon			-	-	-	5.0	-	-	-	42.0	-	-	-	-	-	-
Duel	6	F	4.0	3.5	2.8	-	2.9	35.1	5.8	-	86.7	32.5	5.6	-	3.0	3.5
Duke	6	F	4.3	3.3	2.7	-	3.4	42.1	9.1	-	43.3	10.8	2.8	-	2.5	3.0

Excel	6	M	4.3	3.7	2.8	3.7	5.3	41.6	9.7	20.0	86.7	25.8	4.9	VP	2.5	3.0
Falcon	6	H	5.0	5.0	5.0	4.7	3.9	38.5	19.1	19.1	76.7	21.7	2.0	VP	4.5	6.5
Foster	6	M	5.0	2.7	2.7	-	5.6	32.1	14.7	-	86.7	25.0	4.8	-	2.0	2.0
Harrington	2	M	4.7	3.0	2.8	1.7	1.1	13.2	6.9	8.9	23.3	5.8	1.0	F+	6.0	8.0
HB364	2	H	-	-	-	2.3	-	-	-	5.0	-	-	-	-	-	-
CDC Fibar	2	H	-	-	-	2.3	-	-	-	9.8	-	-	-	-	-	-
HB805	2	H	-	3.0	2.5	3.5	-	20.2	8.5	9.1	-	-	-	-	4.0	5.0
Heartland	6	F	5.0	4.7	3.0	-	3.9	46.5	20.4	9.1	86.7	23.3	5.2	-	4.5	4.5
Jaeger	6	H	5.0	5.0	5.0	5.0	13.2	75.1	47.2	38.2	83.3	25.0	4.7	VP	5.5	5.5
Kasota	6	F	5.0	4.7	4.5	4.7	7.6	55.9	26.3	16.1	93.3	31.7	6.9	VP	5.5	6.0
Lacey	6	M	4.7	3.7	3.3	3.0	8.4	25.0	10.8	17.8	-	-	-	P	2.5	3.0
Leduc	6	F	5.0	3.7	3.7	-	2.3	38.3	9.5	-	76.7	19.2	5.0	-	4.0	5.0
Legacy	6	M	4.7	3.7	2.7	3.2	3.3	32.8	13.5	11.8	93.3	30.0	6.9	P	3.0	4.0
Mahgan	6	F	5.0	5.0	5.0	4.7	6.3	57.2	16.0	15.5	93.3	28.3	5.8	VP	4.0	4.0
Manley	2	M	4.0	3.3	2.5	-	2.1	26.1	9.7	-	36.7	9.2	1.9	F	5.0	7.5
Merit	2	M	4.3	3.3	3.2	4.2	2.3	25.7	7.3	16.1	40.0	10.0	1.3	F	4.0	6.5
Merlin	2	H ^a	-	4.3	5.0	5.0	-	20.2	9.6	11.6	-	-	-	-	6.0	8.0
Newdale	2	M	3.3	3.0	3.2	3.2	2.1	26.6	12.2	14.0	40.0	10.0	2.7	F	2.5	3.0
Nicobe	2	F	5.0	3.3	3.0	3.0	1.9	38.2	9.3	16.0	-	-	-	F	4.5	6.0
Niska	6	F	4.7	4.0	4.0	5.0	4.1	47.7	13.2	22.1	86.7	28.3	5.8	VP	2.0	3.0
Peregrine	6	H	5.0	4.0	3.2	4.3	8.7	42.7	20.5	37.4	90.0	25.8	5.0	VP	3.0	3.5
Phoenix	2	H	2.7	2.0	1.5	1.0	2.1	7.5	3.9	2.6	46.7	11.7	2.9	F+	-	-
Rivers	2	F	2.7	2.3	2.7	2.8	2.7	22.9	12.9	11.3	40.0	10.8	2.1	F	4.5	5.5
Robust	6	M	4.0	4.2	2.5	3.2	3.9	46.3	14.0	11.6	96.7	25.8	5.2	VP	2.5	3.0
Seebe	2	F	4.7	2.3	2.0	1.0	2.6	12.9	7.7	7.2	30.0	7.5	0.9	F+	6.0	8.5
Stander	6	F	4.7	4.0	2.8	3.3	5.5	58.7	17.8	17.0	96.7	26.7	5.0	VP	2.0	2.5
Stein	2	M	4.3	3.3	3.0	4.0	2.6	21.9	13.7	13.1	46.7	11.7	2.0	F	6.5	8.5
Stetson	6	F	5.0	5.0	5.0	-	8.1	160.7	24.4	-	80.0	20.8	5.2	-	5.5	7.0
Tankard	6	M ^a	3.3	3.0	3.7	2.7	2.2	24.5	12.9	9.6	66.7	16.7	2.2	F	1.5	1.5
Tercel	2	H	5.0	3.7	3.5	3.5	3.0	34.3	10.6	4.7	43.3	10.8	2.3	P	6.5	9.0
TR145	2	M	2.7	2.7	3.2	-	1.0	18.5	9.9	-	20.0	5.0	0.7	-	5.0	6.0
TR167	2	M	4.0	2.5	2.0	-	1.8	14.6	8.9	-	-	-	-	-	-	-
TR169	2	M	4.0	2.7	1.8	-	2.1	21.4	7.7	-	-	-	-	-	3.0	5.5
TR361	2	F	3.7	2.0	2.2	-	1.5	18.5	6.2	-	-	-	-	F+	5.0	7.0
TR706	2	M	-	3.3	4.0	-	-	32.2	8.4	-	-	-	-	-	2.5	2.5
TR176	2	M	-	-	-	3.7	-	-	-	10.6	-	-	-	-	-	-
TR656	2	-	-	-	-	3.3	-	-	-	7.4	-	-	-	-	-	-
TR710	2	-	-	-	-	4.7	-	-	-	10.5	-	-	-	-	-	-
TR711	2	-	-	-	-	3.2	-	-	-	7.1	-	-	-	-	-	-
Tradition	6	-	-	-	-	2.7	-	-	-	14.6	-	-	-	-	-	-
Trochu	6	F	5.0	3.7	3.8	3.2	3.9	52.9	9.2	9.0	100.0	27.5	4.2	VP	2.5	3.5
Tukwa	6	F	4.3	4.7	4.3	-	4.3	28.6	5.0	-	86.7	23.3	6.9	-	2.5	3.5
Tyto	6	H	4.3	4.0	3.7	4.5	4.1	35.3	11.2	13.3	-	-	-	P	3.0	4.5
Varden	6	F ²	4.0	4.3	4.0	4.3	7.9	50.2	19.6	14.3	90.0	25.8	6.4	VP	3.0	4.0
Vivar	6	F	5.0	4.7	4.7	5.0	9.2	75.2	12.2	25.1	86.7	24.2	4.0	VP	4.5	4.5
Westford	6	F ²	5.0	5.0	4.7	5.0	3.1	47.4	19.6	36.5	100.0	29.2	5.2	VP	5.0	5.0
Winthrop	2	F	3.7	3.0	1.8	-	1.7	28.3	6.1	-	40.0	10.8	1.4	-	4.5	5.5
Xena	2	F	2.7	3.3	1.2	1.8	1.7	22.3	6.6	7.1	73.3	20.8	6.0	F	4.5	7.0
Grand Mean			4.0	3.4	3.0	3.4	3.2	32.2	11.7	14.1	62.3	18.2	3.5			
Min			2.3	2.0	1.2	1.0	0.8	7.5	3.0	2.6	10.0	2.5	0.4			
Max			5.0	5.0	5.0	5.0	13.2	160.7	47.2	42.0	100.0	62.5	9.8			
LSD (0.05)			1.0	1.0	1.0	-	3.3	15.9	5.7	-	-	-	-			
CV (%)			15.3	18.1	21.1	-	62.9	30.5	29.9	-	-	-	-			

¹ DON = deoxynivalenol content (mg kg⁻¹) from Brandon, MB (n=3).

² Provincial Seed Guide Rating: No barley variety has 'Very Good' or 'Good' resistance to FHB.

Categories: F+ = Fair plus; F = Fair; P = Poor; VP = Very Poor; '-' = not included in any of the guides.

³ Spot Blotch = Spot Blotch Ratings (*C. sativus*; 1-9 scale) taken from Brandon Leaf Disease Nursery (n=2).

Not inoculated with *F. graminearum*. Spot 1 = first spot blotch rating rated the week of July 29

Spot 2 = second spot blotch rating rated the week of Aug. 5.

⁴ M = malt barley, F = feed barley, H = hullless barley, H^a = Hullless waxy,

M^a = malt barley with blue aleurone, F² = forage barley.

⁵ DON = Composite sample of 3 replicates, as measured by ELISA technique at ECORC, Ottawa.

Table 7. Germplasm from Eastern Cereal and Oilseed Research Centre (ECORC), AAFC Ottawa with promising FHB resistance.

Best Entries Tested over Three Years													
NAME	Pedigree	Row Type	FHB		DON		China-2000-01		China-2001-02		China-2002-03		
			2000 ¹	2001	2000 ¹	2001	2002	2001	2002	2001	2002	2001	
AC Meicalle	check	2	3.3 (3.0)	3.0	2.0	2.0 (2.1)	23.3	13.9	26.7	7.1	1.5	83.6	60.7
CI4196	check	2	1.0 (2.0)	2.0	3.5	1.4 (0.9)	15.9	13.0	12.9	3.2	0.5	5.1	24.7
Stander	check	6	4.7 (4.0)	3.7	3.5	5.5 (8.8)	60.1	15.0	76.5	26.3	5.4	98.3	85.8
CDC Sisler	check	6	(3.5)	3.0	-	(4.4)	33.0	-	79.5	28.8	5.1	92.2	33.0
Chevron	check	6	(1.5)	2.5	-	(1.6)	25.8	-	53.3	15.4	2.3	86.8	22.2
Robust	check	6	(3.5)	4.0	-	(5.1)	44.2	-	83.4	32.1	5.6	97.6	87.2
H5277-12	AC Stephens/ Chevron	6	-	3.0	2.5	-	12.9	9.3	-	-	-	25.0	8.5
H5277-50	AC Stephens/ Chevron	6	-	3.0	1.8	-	19.2	7.1	-	-	-	77.4	29.0
H5277-57	AC Stephens/ Chevron	6	-	2.7	2.0	-	15.3	9.3	-	-	-	30.0	7.5
H5277-60	AC Stephens/ Chevron	6	2.3	3.7	2.5	1.1	21.3	4.7	26.7	6.7	2.0	46.7	11.7
H5277-64	AC Stephens/ Chevron	6	-	3.0	3.5	-	25.0	5.9	-	-	-	71.0	22.6
2-3	Ingrid/ H. spontaneum	2	3	3.7	1.7	1.5	20.1	3.9	23.3	6.7	1.3	28.6	8.9
Promising barley lines from H. bulbosum crosses tested in 2002													
NAME	Pedigree	Row Type	FHB		DON		China-2000-01		China-2001-02		China-2002-03		
			2000	2001	2002	2001	2002	2001	2002	2001	2002	2001	
AC Meicalle	check	2	-	-	3.3	-	21.9	-	-	-	-	60.7	6.6
CI4196	check	2	-	-	2.8	-	14.7	-	-	-	-	24.7	6.3
Stander	check	6	-	-	4.0	-	21.6	-	-	-	-	85.8	35.6
CDC Sisler	check	6	-	-	3.0	-	8.0	-	-	-	-	33.0	8.2
Chevron	check	6	-	-	1.0	-	5.9	-	-	-	-	22.2	5.6
Robust	check	6	-	-	5.0	-	16.3	-	-	-	-	87.2	36.8
A 53-86-2	H. bulbosum in pedigree	2	-	-	3.0	-	5.5	-	-	-	-	33.3	8.3
CHT 439-20 HY-10	H. bulbosum in pedigree	2	-	-	2.5	-	8.2	-	-	-	-	76.7	20.0
Eloose x # 2GP x 313-2 (package 1)	H. bulbosum in pedigree	2	-	-	3.0	-	10.8	-	-	-	-	33.3	8.3
Eloose x # 2GP x 313-2 (package 2)	H. bulbosum in pedigree	2	-	-	3.5	-	10.9	-	-	-	-	50.0	12.5

¹ Data in brackets for line 2-3 (Ingrid/ H. spontaneum) which was tested separately in 2000

2003 North American Barley Scab Evaluation Nursery (Brandon Site).

Entry	Name	PEDIGREE	SOURCE	Days to Heading	Severity (%)	Incidence (%)	DON (ppm) *
1	ND20369	ND16918C98-62-3	NDSU	48.5	4.9	77.5	7.8
2	ND20368	ND16918C98-62-3	NDSU	48.5	13.2	95.0	10.1
3	ND20406	ND16918C98-62-3	NDSU	47.0	8.1	97.5	10.8
4	ND20407	ND16918C98-62-3	NDSU	48.5	4.8	87.5	11.2
5	ND20452	ND16918*2C190 15258	NDSU	49.5	9.4	82.5	15.4
6	ND20493	ND16918*2C190 8611	NDSU	45.5	4.0	80.0	5.0
7	ND20539	ND16918*2C190 5809	NDSU	48.5	13.9	85.0	11.5
8	ND20540	ND16918*2C190 5639	NDSU	48.5	7.4	97.5	10.2
9	LEGACY	BUMPER / KAHN // BUMPER / MANKER / VJ BUMPER / KARL // EXCEL	BAR	49.3	8.9	75.0	18.4
10	TRADITION	6889-2126 / ND10981	BAR	48.0	11.6	62.5	13.5
11	6898 9022	6892-7098 / 6892-7166	BAR	48.0	14.0	87.5	13.7
12	6899-6339	6892-8177 / 6894-7862	BAR	50.3	24.8	100.0	18.2
13	6899-6774	LEGACY / 6894-7862	BAR	50.8	23.6	95.0	24.3
14	6800-1100	6894-7378 // LEGACY / 6894-7544	BAR	47.5	9.9	97.5	17.1
15	6800-1323	6894-8126 // LEGACY / 6895-6311	BAR	50.5	16.2	95.0	18.4
16	6800-1499	6894-7378 // LEGACY / 6894-7416	BAR	49.3	25.9	100.0	20.1
17	AC Bountiful	Wp943-224 Marley // AC Oxbow/Marley	AAFC: Legge	54.5	6.7	80.0	8.9
18	Calder	TR239/7R238	AAFC: Legge	52.0	9.7	90.0	8.4
19	EX645-3-6	(Br. CC 053/81602/8213/8067/Conquest/Minn. M82/81946/Gainer	AAFC: Thermen	53.5	3.8	65.0	3.3
20	EX702-4-6	(BR. CC 053/Mg22/1/Steven/Elican/Norbert/Bonanza/Harrington/81946/Bacon)	AAFC: Thermen	50.3	12.1	87.5	4.8
21	SH01285	CDC Freedom/ C2-83-6-12	CDC-Roanagel & Zatorski	55.0	4.0	87.5	2.4
22	SB00106	TR338/7R251	CDC-Roanagel & Zatorski	49.8	9.8	85.0	9.2
23	CDC Select	AC Metcalfe/ TR116	U of SK-Harvey & Lefol	53.0	18.0	100.0	13.2
24	CDC Bantford	M87/8T411	U of SK-Harvey & Lefol	52.0	22.6	100.0	15.7
25	FE643-46	MAS2-54Lacey	U of MN	50.3	17.0	97.5	21.1
26	FE643-47	MAS2-54Lacey	U of MN	50.5	8.6	87.5	11.7
27	FE644-12	FE62-26MNBella	U of MN	50.0	21.5	92.5	16.0
28	FE655-04	FE62-26MNBella	U of MN	50.0	7.3	82.5	6.4
29	FE657-28	FE610-16/FE64-08	U of MN	47.3	2.8	75.0	5.5
30	FE659-36	FE614-119/FE610-16	U of MN	48.5	3.5	60.0	6.2
31	FE681-27	C190 8613/Lacey	U of MN	50.8	9.1	90.0	9.2
32	FE686-08	FE616-20M96-64	U of MN	51.5	8.6	90.0	6.3
33	03C-1	TOCTE/GOB1/HUMAI/Q3/ATAH92/ALEU	ICARDACHMYT	50.8	17.4	90.0	9.1
34	03C-2	PERCO/CHVIRON BAR	ICARDACHMYT	52.0	28.0	97.5	12.0
35	03C-3	ATAH92/GOB	ICARDACHMYT	48.8	18.0	90.0	12.0
36	03C-4	Logan/ND16436/ND15409	ICARDACHMYT	47.8	8.4	80.0	14.1
37	03C-5	SVANHALS-BARMSEL/AZAF/GOB24DH	ICARDACHMYT	58.0	4.8	90.0	9.0
38	03C-6	SVANHALS-BAR	ICARDACHMYT	45.5	13.8	87.5	7.4
39	03C-7	ARUPQ/K8755/MORA	ICARDACHMYT	48.0	12.8	87.5	11.5
40	03C-8	GOB24DH	ICARDACHMYT	50.0	18.8	90.0	17.9
41	ND 19836	Logan/ND16436/ND15409	NDSU	47.5	3.4	50.0	13.7
42	ND 19854	ND 15403-3/ND16462	NDSU	48.5	7.4	80.0	17.3
43	ND19119	ND15403-3/ND15368/ND16453	NDSU	48.0	14.1	85.0	21.0
44	ND 19929	TR258/ND17437	NDSU	49.8	11.3	90.0	14.6
45	ND 20833	TR258/ND1609-1/ND16461-1	NDSU	51.3	25.3	90.0	11.4
46	MnBile	M90-89/M69	check	51.5	16.8	97.5	8.8
47	Centon	BOWMAN/2DWS/1008/ND10232	check	45.0	7.6	85.0	8.7
48	Robust	MOREX/MANKER	check	50.3	14.4	85.0	13.7
49	CIHO 4196	UNKNOWN	check	56.3	4.7	92.5	5.8
50	Chevron	UNKNOWN	check	53.5	2.8	60.0	7.4
51	Standar	ROBUST/23CREE/BONANZA/MANKER/ROBUST/BUMBER	check	50.3	29.8	100.0	20.2

* DON = Deoxynivalenol content (ppm) measured by ELISA technique at ECORC, Ottawa
Assay conducted on a composite sample of 4 replicates

Table 9. Miscellaneous FHB Resistant Sources

Row Type		Days to Heading				Height	FHB Rating				DON (ppm)				China-2000/01				China-2002/03			
		2000 2001 2002 2003					2000 2001 2002 2003				2000 2001 2002 2003				Diseased Disease Spikes(%) Index				Diseased Disease Spikes(%) Index			
		2000	2001	2002	2003		2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003
AC Metcalfe	2, check	59.7	65.0	52.0	54.0	83.5	3.3	2.5	2.5	2.8	2.0	30.1	9.7	17.5	26.7	7.1	1.5	43.3	7.7	11.7		
CI4196	2, check	71.3	69.0	60.0	61.5	88.5	1.0	1.0	2.3	1.8	1.4	11.7	5.9	7.4	12.9	3.2	0.5	17.6	1.0	4.4		
Stander	6, check	54.0	53.5	47.5	52.5	81.0	4.7	3.0	3.3	5.0	5.5	51.4	12.7	22.1	76.5	26.3	5.4	87.5	37.2	43.8		
CDC Sisler	6, check	-	62.0	48.0	53.0	92.5	-	3.3	3.5	2.8	-	20.4	9.5	7.9	79.5	28.8	5.1	83.3	15.2	27.5		
Chevron	6, check	-	57.0	53.0	52.0	107.0	-	1.5	2.5	0.8	-	8.9	4.5	6.8	53.3	15.4	2.3	-	-	-		
Robust	6, check	-	59.5	46.0	49.5	91.5	-	3.5	4.5	3.3	-	33.4	9.3	18.1	83.4	32.1	5.6	86.7	26.3	35.0		
6NDRFG-1	6	-	-	51.3	53.0	-	-	-	2.3	1.2	-	-	6.3	2.5	-	-	-	-	-	-		
AB 159-2	2	-	67.0	50.0	-	97.7	-	2.0	2.2	-	-	15.1	11.5	-	-	-	-	-	-	-		
AC Bountiful	2	62.0	65.0	52.0	54.7	83.0	2.3	2.0	2.7	2.5	1.6	29.3	10.1	7.2	20.0	5.0	1.0	-	-	-		
AC Buffalo	6	57.3	56.3	47.7	53.7	85.3	3.7	4.3	2.7	-	3.2	40.8	7.2	-	53.3	18.3	3.9	-	-	-		
AC Metcalfe	2	58.0	62.0	52.0	52.7	90.0	3.7	2.0	2.8	3.3	2.5	27.3	12.3	11.0	23.3	5.8	1.0	-	-	-		
AC Oxbow	2	61.7	62.0	52.3	54.0	85.0	3.0	2.0	2.2	2.0	1.2	18.4	9.6	7.5	30.0	7.5	1.6	-	-	10.8		
AC Sterling	2	60.7	64.0	50.7	51.0	84.0	2.3	2.0	2.2	3.2	0.7	19.0	7.8	13.8	40.0	14.2	1.9	-	-	6.3		
Akka W6039	2	52.7	57.0	49.7	52.3	83.3	3.0	2.7	3.7	-	7.3	55.6	23.4	-	16.7	4.2	1.0	-	-	-		
Atahualpa 92	2, hullless	60.7	65.3	51.7	-	73.0	2.0	2.3	1.8	2.3	2.8	8.1	11.8	6.0	23.1	5.8	1.2	-	-	-		
CDC Kendall	2	59.7	63.7	51.3	52.3	78.0	2.3	2.0	2.2	4.2	1.6	19.1	7.7	13.3	13.3	3.3	0.9	-	-	3.3		
CDC Sisler	6	58.3	60.0	48.7	52.3	92.0	4.0	3.0	2.3	2.2	3.6	24.4	6.7	8.3	80.0	41.7	7.2	-	-	-		
CDC Stratus	2	62.0	66.7	51.7	52.7	68.0	3.3	2.7	3.3	3.8	1.5	21.6	13.6	9.7	30.0	7.5	1.4	-	-	-		
Chevron	6	62.3	61.3	51.0	54.3	106.7	1.3	1.3	1.8	0.8	1.6	20.0	4.4	3.6	50.0	19.2	6.2	-	-	-		
CI4196	2	72.0	67.7	56.3	59.3	93.0	1.7	1.3	1.8	1.0	0.7	6.9	6.4	3.7	13.3	3.3	1.2	-	-	-		
CI 8826	2	-	54.7	40.0	38.3	75.0	-	2.3	2.3	2.8	-	23.8	5.0	1.4	-	-	-	-	-	-		
Duli-Liang	6	-	60.3	43.0	51.3	67.7	-	4.0	3.8	4.2	-	18.2	8.5	9.3	-	-	-	-	-	-		
Excel	6	55.7	58.0	48.3	-	82.0	4.3	4.2	3.2	-	8.2	45.9	14.0	-	73.3	34.2	7.6	-	-	5.1		
Frederickson	2	61.7	62.0	52.7	56.0	102.3	2.3	1.7	2.8	3.3	2.5	22.4	6.6	4.0	23.3	8.3	1.6	-	-	12.5		
Fuji Nijo	2	-	53.7	42.3	44.0	73.0	-	2.3	2.5	1.5	-	20.2	4.7	5.8	-	-	-	-	-	-		
Gob/Humai 10	2	47.7	53.0	43.0	44.0	68.7	3.7	2.7	1.2	1.5	3.3	28.0	6.2	5.0	20.0	5.0	1.0	-	-	3.5		
Gobernadora	2	52.7	60.0	46.7	47.3	77.3	4.3	2.5	3.2	2.8	4.8	32.0	9.0	16.6	33.3	10.0	1.8	-	-	3.8		
Golozernyj 1	2	61.3	65.0	52.0	52.7	98.3	2.3	2.0	2.5	1.2	1.3	8.7	2.3	2.9	17.9	5.4	1.3	-	-	2.2		
Harbin	2	62.0	60.3	52.0	53.7	94.0	2.0	1.3	2.5	1.0	1.6	12.5	5.6	7.9	13.3	3.3	0.9	-	-	-		
Horn Peseky 2	2	56.0	60.3	49.0	50.7	82.0	4.0	2.3	2.5	3.0	1.5	20.5	7.9	7.8	40.0	11.7	2.2	-	-	-		
I94257	2	55.7	62.3	50.0	50.7	73.7	4.7	3.7	4.3	4.0	1.4	22.9	9.9	12.5	63.3	24.2	3.8	-	-	-		
Krasnojarskij 1	2	53.7	55.3	49.3	46.3	98.0	1.7	2.0	1.7	1.3	1.1	16.8	5.5	3.1	36.7	10.8	1.1	-	-	1.8		
Kyoto Nakate	2	-	62.0	54.0	56.7	100.0	-	2.3	2.7	2.8	-	15.9	8.8	4.4	-	-	-	-	-	-		
Maja	2	-	68.7	53.3	57.0	89.3	-	2.7	2.5	3.0	-	18.2	9.2	8.3	-	-	-	-	-	-		
Maris Mink	2	71.0	66.7	65.0	-	68.3	4.7	2.7	3.5	-	5.4	14.3	15.1	-	14.3	3.6	0.4	-	-	-		
MNBrite	6	-	46.7	50.0	-	-	-	-	2.2	2.0	-	-	9.3	9.2	-	-	-	-	-	-		
Morrison	2	56.0	65.7	52.3	51.7	74.0	4.0	2.7	2.5	4.7	2.0	17.7	11.7	15.1	60.0	26.7	3.1	-	-	17.3		
Murasaki-mochi	6	51.3	58.0	44.3	44.0	85.0	2.3	3.3	2.5	3.2	2.7	22.0	5.4	8.4	70.0	33.3	7.2	-	-	5.2		
Nepolegaluscij	2	54.7	58.7	55.7	50.7	91.7	1.3	2.0	1.8	1.0	1.2	12.0	7.4	5.9	30.0	8.3	0.9	-	-	-		
Niedzial	2	62.3	65.0	63.3	54.7	79.3	2.7	1.7	3.2	2.8	1.2	10.4	12.8	6.9	16.7	4.2	0.8	-	-	4.1		

	6	53.7	59.5	48.0	-	95.8	3.3	3.0	2.5	-	4.4	38.4	9.1	-	66.7	25.0	4.8	-	-	-
Nordic	6	53.7	59.5	48.0	-	95.8	3.3	3.0	2.5	-	4.4	38.4	9.1	-	66.7	25.0	4.8	-	-	-
Primus	2	65.7	68.7	66.0	58.0	89.0	3.0	2.3	2.3	1.5	1.0	9.2	9.1	6.4	10.0	2.5	0.3	46.7	12.5	5.5
Robust	6	55.0	58.7	48.0	-	89.7	4.3	3.7	3.5	-	6.2	44.9	16.3	-	53.9	17.5	3.1	-	-	-
Seijo II	2	64.7	62.0	62.3	56.0	77.0	3.3	2.0	2.5	3.3	3.5	26.1	9.9	10.0	23.3	5.8	1.1	15.8	3.9	1.1
Shyri	2	59.7	65.0	53.0	54.0	90.7	3.7	2.0	2.8	3.3	3.8	22.4	17.7	8.2	60.0	16.7	2.5	70.6	17.6	7.4
Stander	6	53.3	55.3	47.7	50.0	80.3	5.0	3.0	3.7	4.0	10.2	47.1	25.6	8.7	83.3	33.3	7.9	-	-	-
Suvenir	2	66.0	66.5	53.3	54.3	76.5	3.0	2.7	3.3	3.0	1.3	21.2	11.1	7.2	40.0	11.7	1.6	80.0	20.0	6.4
Svanhals	2	63.0	69.7	57.3	57.0	89.3	2.7	1.7	2.8	1.7	1.3	10.4	11.6	4.9	6.7	1.7	0.1	-	-	-
Svansota	2	-	62.0	52.3	55.7	94.7	-	1.0	1.8	1.0	-	15.1	4.1	4.2	-	-	-	-	-	-
Symko	2	55.7	62.7	49.7	51.7	83.0	4.0	3.0	2.0	2.5	0.9	21.2	6.2	8.5	33.3	9.2	1.3	50.0	12.5	4.5
T186-1	2	-	65.0	49.3	51.3	78.3	-	2.3	2.0	2.8	-	12.2	6.2	8.9	-	-	-	46.7	12.5	5.1
Ussurijskij 8	2	59.3	62.0	53.3	50.7	96.3	3.7	1.7	2.3	1.0	1.0	14.5	6.1	6.9	40.0	10.8	1.5	50.0	12.5	3.1
Wing	2	-	62.0	53.3	56.0	78.3	-	2.7	2.7	3.0	-	23.3	8.4	5.1	-	-	-	-	-	-
Zaoshu 3	2	45.7	48.7	39.3	37.0	65.0	3.7	2.3	3.2	2.7	4.5	28.2	11.0	8.9	10.0	2.5	0.1	16.7	4.2	0.8
Zhedar #1	2	66.0	62.0	60.0	57.0	99.3	2.3	1.0	2.0	1.8	1.6	14.7	8.9	5.8	26.7	6.7	0.0	-	-	-
Average		58.9	61.6	51.3	51.9	84.7	3.1	2.4	2.6	2.5	2.8	22.1	9.5	7.5	35.8	12.3	2.3	48.4	12.6	5.1

Table 9. Miscellaneous FHB Resistant Sources

Row Type	Days to Heading				Height	FHB Rating				DON (ppm)				China-2000/01				China-2002/03			
	2000	2001	2002	2003		2001	2002	2003	2000	2001	2002	2003	Spikes(%)	Diseased Index	Seeds(%)	Spikes(%)	Diseased Index	Seeds(%)			
2, check	59.7	65.0	52.0	54.0	83.5	3.3	2.5	2.5	2.8	2.0	30.1	9.7	17.5	26.7	7.1	1.5	43.3	7.7	11.7		
2, check	71.3	69.0	60.0	61.5	88.5	1.0	1.0	2.3	1.8	1.4	11.7	5.9	7.4	12.9	3.2	0.5	17.6	1.0	4.4		
6, check	54.0	53.5	47.5	52.5	81.0	4.7	3.0	3.3	5.0	5.5	51.4	12.7	22.1	76.5	26.3	5.4	87.5	37.2	43.8		
CDC Sister	-	62.0	48.0	53.0	92.5	-	3.3	3.5	2.8	-	20.4	9.5	7.9	79.5	28.8	5.1	83.3	15.2	27.5		
6, check	-	57.0	53.0	52.0	107.0	-	1.5	2.5	0.8	-	8.9	4.5	6.8	53.3	15.4	2.3	-	-	-		
6, check	-	59.5	46.0	49.5	91.5	-	3.5	4.5	3.3	-	33.4	9.3	18.1	83.4	32.1	5.6	86.7	26.3	35.0		
2ND18365	2	-	-	52.7	-	-	-	-	2.0	-	-	-	7.0	-	-	-	-	-	-		
2ND20040	2	-	-	45.3	-	-	-	-	1.5	-	-	-	7.7	-	-	-	-	-	-		
2ND20049	2	-	-	54.3	-	-	-	-	1.7	-	-	-	4.8	-	-	-	-	-	-		
6NDRFG-1	6	-	-	51.3	53.0	-	-	-	2.3	1.2	-	-	6.3	2.5	-	-	-	-	-		
AB 159-2	2	-	67.0	50.0	97.7	-	2.0	2.2	-	-	15.1	11.5	-	-	-	-	-	-	-		
AC Bountiful	2	62.0	65.0	52.0	54.7	83.0	2.3	2.0	2.7	2.5	1.6	29.3	10.1	7.2	20.0	5.0	1.0	-	-		
AC Buffalo	6	57.3	56.3	47.7	-	85.3	3.7	4.3	2.7	-	3.2	40.8	7.2	-	53.3	18.3	3.9	-	-		
6, hullless	-	-	-	53.7	-	-	-	-	1.7	-	-	-	2.2	-	-	-	-	-	-		
AC Hawkeye	2	58.0	62.0	52.0	52.7	90.0	3.7	2.0	2.8	3.3	2.5	27.3	12.3	11.0	23.3	5.8	1.0	-	-		
AC Metcalfe	2	61.7	62.0	52.3	54.0	85.0	3.0	2.0	2.2	2.0	1.2	18.4	9.6	7.5	30.0	7.5	1.6	88.2	22.1		
AC Oxbow	2	60.7	64.0	50.7	51.0	84.0	2.3	2.0	2.2	3.2	0.7	19.0	7.8	13.8	40.0	14.2	1.9	60.0	15.0		
AC Sterling	2	52.7	57.0	49.7	52.3	83.3	3.0	2.7	3.7	-	7.3	55.6	23.4	-	16.7	4.2	1.0	-	-		
Akka W6039	2	60.7	65.3	51.7	-	73.0	2.0	2.3	1.8	2.3	2.8	8.1	11.8	6.0	23.1	5.8	1.2	-	-		
Alahualpa 92	2, hullless	-	-	56.7	-	-	-	-	1.5	-	-	-	5.3	-	-	-	-	-	-		
Azul	6	-	-	53.0	-	-	-	-	1.0	-	-	-	4.2	-	-	-	-	-	-		
CDC Freedom	2, hullless	-	-	52.3	-	-	-	-	1.0	-	-	-	4.2	-	-	-	-	-	-		
CDC Kendall	2	59.7	63.7	51.3	52.3	78.0	2.3	2.0	2.2	4.2	1.6	19.1	7.7	13.3	13.3	3.3	0.9	40.0	10.0		
CDC Sister	6	58.3	60.0	48.7	52.3	92.0	4.0	3.0	2.3	2.2	3.6	24.4	6.7	8.3	80.0	41.7	7.2	-	-		
CDC Stratus	2	62.0	66.7	51.7	52.7	68.0	3.3	2.7	3.3	3.8	1.5	21.6	13.6	9.7	30.0	7.5	1.4	-	-		
Chevron	6	62.3	61.3	51.0	54.3	106.7	1.3	1.3	1.8	0.8	1.6	20.0	4.4	3.6	50.0	19.2	6.2	-	-		
CI4196	2	72.0	67.7	56.3	59.3	93.0	1.7	1.3	1.8	1.0	0.7	6.9	6.4	3.7	13.3	3.3	1.2	-	-		
CI 8826	2	-	54.7	40.0	38.3	75.0	-	2.3	2.3	2.8	-	23.8	5.0	1.4	-	-	-	-	-		
CIho-11526	6	-	-	55.0	-	-	-	-	1.7	-	-	-	3.7	-	-	-	-	-	-		
CIho-11976	2	-	-	45.7	-	-	-	-	0.8	-	-	-	4.6	-	-	-	-	-	-		
CIho-16128	6	-	-	55.0	-	-	-	-	1.3	-	-	-	3.5	-	-	-	-	-	-		
CIho-4226	2	-	-	56.3	-	-	-	-	3.3	-	-	-	3.4	-	-	-	-	-	-		
CIho-4241	6	-	-	37.0	-	-	-	-	1.8	-	-	-	2.3	-	-	-	-	-	-		
CIho-4635	6	-	-	48.0	-	-	-	-	0.8	-	-	-	6.5	-	-	-	-	-	-		
CIho-6613	6	-	-	52.7	-	-	-	-	1.8	-	-	-	8.9	-	-	-	-	-	-		
Conlon	2	-	-	46.0	-	-	-	-	1.8	-	-	-	5.4	-	-	-	-	-	-		
Doneckij 6	6	-	-	52.0	-	-	-	-	2.3	-	-	-	4.4	-	-	-	-	-	-		
Duli-Liang	6	-	60.3	43.0	51.3	67.7	-	4.0	3.8	4.2	-	18.2	8.5	9.3	-	-	-	-	-		
FEG 18-40	6	-	-	51.7	-	-	-	-	2.5	-	-	-	5.2	-	-	-	-	-	-		
FEG 27-56	6	-	-	50.0	-	-	-	-	2.3	-	-	-	11.0	-	-	-	-	-	-		
FEG 33-89	6	-	-	49.3	-	-	-	-	2.5	-	-	-	9.9	-	-	-	-	-	-		

FEG 38-12	6	-	-	-	-	50.7	-	-	-	-	-	-	4.0	-	8.2	45.9	14.0	-	73.3	34.2	7.6	-	-	-
Excel	6	55.7	58.0	48.3	-	102.3	2.3	1.7	2.8	3.3	2.5	22.4	6.6	4.0	23.3	8.3	-	-	50.0	12.5	5.1	-	-	-
Frederickson	2	-	53.7	42.3	44.0	73.0	-	2.3	2.5	1.5	-	20.2	4.7	5.8	-	-	-	-	36.7	9.2	3.5	-	-	-
Fuji Nijo	2	47.7	53.0	43.0	44.0	68.7	3.7	2.7	1.2	1.5	3.3	28.0	6.2	5.0	20.0	5.0	-	-	36.7	9.2	3.5	-	-	-
Gob/Humai 10	2	52.7	60.0	46.7	47.3	77.3	4.3	2.5	3.2	2.8	4.8	32.0	9.0	16.6	33.3	10.0	-	-	36.7	9.2	3.5	-	-	-
Gobernadora	2	61.3	65.0	52.0	52.7	98.3	2.3	2.0	2.5	1.2	1.3	8.7	2.3	2.9	17.9	5.4	-	-	36.7	9.2	3.5	-	-	-
Golozermyj 1	2	62.0	60.3	52.0	53.7	94.0	2.0	1.3	2.5	1.0	1.6	12.5	5.6	7.9	13.3	3.3	-	-	-	-	-	-	-	-
Harbin	2	-	-	-	-	42.0	-	-	-	3.2	-	-	-	4.5	-	-	-	-	-	-	-	-	-	-
HDEB4194-622-1	2	56.0	60.3	49.0	50.7	82.0	4.0	2.3	2.5	3.0	1.5	20.5	7.9	7.8	40.0	11.7	-	-	-	-	-	-	-	-
Horni Peseky 2	2	55.7	62.3	50.0	50.7	73.7	4.7	3.7	4.3	4.0	1.4	22.9	9.9	12.5	63.3	24.2	-	-	-	-	-	-	-	-
I94257	2	-	-	-	-	49.7	-	-	-	2.0	-	-	-	7.9	-	-	-	-	14.3	3.6	1.8	-	-	-
Island	2	53.7	55.3	49.3	46.3	98.0	1.7	2.0	1.7	1.3	1.1	16.8	5.5	3.1	36.7	10.8	-	-	-	-	-	-	-	-
Krasnojarskij 1	2	-	62.0	54.0	56.7	100.0	-	2.3	2.7	2.8	-	15.9	8.8	4.4	-	-	-	-	-	-	-	-	-	-
Kyoto Nakate	2	-	68.7	53.3	57.0	89.3	-	2.7	2.5	3.0	-	18.2	9.2	8.3	-	-	-	-	-	-	-	-	-	-
Maja	2	71.0	66.7	65.0	-	68.3	4.7	2.7	3.5	-	5.4	14.3	15.1	-	14.3	3.6	-	-	-	-	-	-	-	-
Maris Mink	2	-	-	-	46.7	50.0	-	-	2.2	2.0	-	-	9.3	9.2	-	-	-	-	-	-	-	-	-	-
MNBrite	6	56.0	65.7	52.3	51.7	74.0	4.0	2.7	2.5	4.7	2.0	17.7	11.7	15.1	60.0	26.7	-	-	-	-	-	-	-	-
Morrison	2	51.3	58.0	44.3	44.0	85.0	2.3	3.3	2.5	3.2	2.7	22.0	5.4	8.4	70.0	33.3	-	-	-	-	-	-	-	-
Murasaki-mochi	6	-	-	-	-	56.0	-	-	-	5.0	-	-	-	17.1	-	-	-	-	-	-	-	-	-	-
Nan Fan No. 3	6, hullless	54.7	58.7	55.7	50.7	91.7	1.3	2.0	1.8	1.0	1.2	12.0	7.4	5.9	30.0	8.3	-	-	-	-	-	-	-	-
Nepolegajuscij	2	62.3	65.0	63.3	54.7	79.3	2.7	1.7	3.2	2.8	1.2	10.4	12.8	6.9	16.7	4.2	-	-	43.3	10.8	4.1	-	-	-
Niedzical	2	53.7	59.5	48.0	-	95.8	3.3	3.0	2.5	-	4.4	38.4	9.1	-	66.7	25.0	-	-	-	-	-	-	-	-
Nordic	6	65.7	68.7	66.0	58.0	89.0	3.0	2.3	2.3	1.5	1.0	9.2	9.1	6.4	10.0	2.5	-	-	46.7	12.5	5.5	-	-	-
Primus	2	55.0	58.7	48.0	-	89.7	4.3	3.7	3.5	-	6.2	44.9	16.3	-	53.9	17.5	-	-	-	-	-	-	-	-
Robust	6	64.7	62.0	62.3	56.0	77.0	3.3	2.0	2.5	3.3	3.5	26.1	9.9	10.0	23.3	5.8	-	-	15.8	3.9	1.1	-	-	-
Seljo II	2	59.7	65.0	53.0	54.0	90.7	3.7	2.0	2.8	3.3	3.8	22.4	17.7	8.2	60.0	16.7	-	-	70.6	17.6	7.4	-	-	-
Shyni	2	53.3	55.3	47.7	50.0	80.3	5.0	3.0	3.7	4.0	10.2	47.1	25.6	8.7	83.3	33.3	-	-	-	-	-	-	-	-
Stander	6	66.0	66.5	53.3	54.3	76.5	3.0	2.7	3.3	3.0	1.3	21.2	11.1	7.2	40.0	11.7	-	-	80.0	20.0	6.4	-	-	-
Suvenir	2	63.0	69.7	57.3	57.0	89.3	2.7	1.7	2.8	1.7	1.3	10.4	11.6	4.9	6.7	1.7	-	-	-	-	-	-	-	-
Svanhals	2	-	62.0	52.3	55.7	94.7	-	1.0	1.8	1.0	-	15.1	4.1	4.2	-	-	-	-	-	-	-	-	-	-
Svansola	2	55.7	62.7	49.7	51.7	83.0	4.0	3.0	2.0	2.5	0.9	21.2	6.2	8.5	33.3	9.2	-	-	50.0	12.5	4.5	-	-	-
Symko	2	-	65.0	49.3	51.3	78.3	-	2.3	2.0	2.8	-	12.2	6.2	8.9	-	-	-	-	46.7	12.5	5.1	-	-	-
T186-1	2	59.3	62.0	53.3	50.7	96.3	3.7	1.7	2.3	1.0	1.0	14.5	6.1	6.9	40.0	10.8	-	-	50.0	12.5	3.1	-	-	-
Ussurijskij 8	2	-	62.0	53.3	56.0	78.3	-	2.7	2.7	3.0	-	23.3	8.4	5.1	-	-	-	-	-	-	-	-	-	-
Wing	2	45.7	48.7	39.3	37.0	65.0	3.7	2.3	3.2	2.7	4.5	28.2	11.0	8.9	10.0	2.5	-	-	16.7	4.2	0.8	-	-	-
Zaoshu 3	2	66.0	62.0	60.0	57.0	99.3	2.3	1.0	2.0	1.8	1.6	14.7	8.9	5.8	26.7	6.7	-	-	-	-	-	-	-	-
Zhedar #1	2	58.9	61.6	51.3	51.4	84.7	3.1	2.4	2.6	2.4	2.8	22.1	9.5	7.1	35.8	12.3	-	-	48.4	12.6	5.1	-	-	-
Average																								

Table 11. Promising Plant Gene Resources of Canada (PGRC) accessions screened at Brandon and Hangzhou, China, in 2001 and 2002.

Name	CN code	Origin	Type ¹	China-01-02										China-02-03										Other Diseases													
				Year 2001 (m=1)					Diseased					Year 2002 (m=2)					Diseased					Year 2003 (m=3)					Diseased					QCCJ			
				Heading	FHB	DON	Spike	Index	Seed	Heading	FHB	DON	Spike	Index	Seed	Heading	FHB	DON	Spike	Index	Seed	Heading	FHB	DON	Spike	Index	Seed	857	858	1493	Stem Rust ²	Scald ³	1493	Rust ⁴			
Mercallie	check		2	61.6	2.8	32.7	100.0	46.8	43.2	52.0	2.1	8.8	54.0	2.8	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.7				
Ch14196	check		2	66.4	2.4	29.8	3.2	0.8	2.1	61.0	2.7	6.5	61.5	1.8	7.4	23.3	2.4	23.3	2.4	23.3	2.4	5.8	-	-	-	-	-	-	-	-	-	-	-				
Slender	check		6	52.2	4.4	59.4	100.0	51.0	38.3	50.0	4.1	11.9	52.5	5.0	22.1	100.0	22.4	100.0	22.4	100.0	22.4	36.7	-	-	-	-	-	-	-	-	-	-	-				
CDC Sister	check		6	54.6	4.8	28.3	73.3	19.2	24.7	49.0	2.6	4.7	53.0	2.8	7.9	73.3	10.3	73.3	10.3	73.3	10.3	24.2	-	-	-	-	-	-	-	-	-	-	-				
Chevron	check		6	60.0	2.6	19.1	80.0	22.5	24.2	51.0	1.0	3.0	52.0	0.8	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Robust	check		6	53.2	4.8	42.9	86.7	29.2	33.2	48.0	3.6	10.5	49.5	3.3	18.1	100.0	16.8	100.0	16.8	100.0	16.8	40.4	-	-	-	-	-	-	-	-	-	-	-				
Azul	CN35781	Russian Federation	6	66	3	29.9	90.0	32.5	8.3	46.0	2.3	2.4	56.7	1.5	5.3	63.3	15.8	63.3	15.8	63.3	15.8	4.5	3	4	S	80.8	-	-	-	-	-	-	-				
Chinese Awless	CN33065	China	6	71	2	3.4	-	-	-	70.5	3.0	-	-	-	-	-	-	-	-	-	-	3	3	4	S	80.8	-	-	-	-	-	-	-				
Ch10-10127	CN88975	Afghanistan	2	68	3	8.0	77.4	23.4	19.0	52.0	3.3	-	-	-	-	-	-	-	-	-	-	7	3	R (MR)	85.8	-	-	-	-	-	-	-	-				
Ch10-10213	CN90523	Afghanistan	2	68	3	24.1	93.5	25.8	27.0	53.5	3.6	-	-	-	-	-	-	-	-	-	-	7	9	S	80.8	-	-	-	-	-	-	-	-				
CN50927	CN50927	Afghanistan	2	53	3	12.7	96.8	29.0	11.1	56.5	3.3	-	-	-	-	-	-	-	-	-	-	8	7	S	70.8	-	-	-	-	-	-	-	-				
Ch10-11755	CN89138	Former Soviet Union	2, H, P	50	2	18.0	40.0	10.0	9.2	48.5	1.8	4.5	45.7	0.8	4.8	100.0	39.7	100.0	39.7	100.0	39.7	22.2	5	3	S	80.8	-	-	-	-	-	-	-				
Ch10-11978	CN81732	China	6	56	3	19.4	-	-	-	50.5	3.5	-	-	-	-	-	-	-	-	-	-	7	4	S	75.8	-	-	-	-	-	-	-	-				
Ch10-3192	CN91458	Japan	2	54	3	23.3	3.2	0.8	0.5	63.5	4.5	-	-	-	-	-	-	-	-	-	-	8	6	S	70.8	-	-	-	-	-	-	-	-				
Ch10-4226	CN91521	China	2	66	3	16.6	96.8	33.9	27.4	53.0	2.3	3.7	56.3	3.3	3.4	35.7	8.9	35.7	8.9	35.7	8.9	2.2	8	4	S	80.8	-	-	-	-	-	-	-				
Ch10-4241	CN91530	China	6	62	2.5	-	-	-	-	38.0	1.8	4.7	37.0	1.8	2.3	96.7	25.8	96.7	25.8	96.7	25.8	10.2	8	4	S	35.3	-	-	-	-	-	-	-				
Ch10-4635	CN91874	Uzbekistan	6, P	56	3	18.1	13.3	3.3	0.6	46.0	3.3	7.8	48.0	0.8	6.5	70.0	20.8	70.0	20.8	70.0	20.8	3.9	5	3	S	70.8	-	-	-	-	-	-	-				
Ch10-4718	CN91765	China	2	56	3	19.3	100.0	46.8	10.8	55.0	2.8	-	-	-	-	-	-	-	-	-	-	5	9	S	85.8	-	-	-	-	-	-	-	-				
Ch10-4720	CN91767	China	2	56	3	21.5	66.7	16.7	2.7	53.5	2.3	6.8	48.0	0.8	6.5	70.0	20.8	70.0	20.8	70.0	20.8	3.9	5	3	S	80.8	-	-	-	-	-	-	-				
Ch10-4725	CN91772	China	2	55	2	19.3	71.0	17.7	3.7	53.0	3.0	-	-	-	-	-	-	-	-	-	-	5	9	S	80.8	-	-	-	-	-	-	-	-				
Ch10-4727	CN91774	China	2	68	3	18.9	56.1	15.3	9.6	56.5	3.5	-	-	-	-	-	-	-	-	-	-	3	9	S	80.8	-	-	-	-	-	-	-	-				
Ch10-4956	CN91945	Armenia	2	68	2	21.0	90.0	47.5	14.8	51.5	3.0	-	-	-	-	-	-	-	-	-	-	3	9	S	80.8	-	-	-	-	-	-	-	-				
Ch10-4963	CN91951	Armenia	2	54	2	19.4	86.7	38.3	19.8	48.0	3.0	-	-	-	-	-	-	-	-	-	-	7	7	S	75.8	-	-	-	-	-	-	-	-				
Ch10-5904	CN92439	Japan	6, H	50	3	26.3	30.0	7.5	0.4	46.5	2.8	12.8	60.0	20.8	4.1	5	2	5	2	5	2	4.1	5	2	S	75.8	-	-	-	-	-	-	-				
Ch10-5905	CN92438	Japan	2, H, P	65	2	19.5	10.0	2.5	2.2	46.0	2.3	8.9	83.3	21.7	7.5	5	3	5	3	5	3	7.5	5	3	S	75.8	-	-	-	-	-	-	-				
Ch10-5929	CN94941	Japan	2	50	2	21.4	30.0	7.5	0.9	52.0	2.3	8.9	66.7	17.5	8.1	9	2	9	2	9	2	8.1	9	2	S	80.8	-	-	-	-	-	-	-				
Ch10-5912	CN95028	China	6, H	87	1	-	-	-	-	55.5	2.3	-	100.0	30.0	16.0	5	8	5	8	5	8	16.0	5	8	S	65.7	-	-	-	-	-	-	-				
Ch10-5918	CN95034	China	6, H	87	1	18.8	-	-	-	66.5	1.5	22.8	-	-	-	-	-	-	-	-	-	-	7	2	S	60.7	-	-	-	-	-	-	-				
Doneckij 6	CN32593	Russian Federation	2	50	2	20.1	76.7	27.5	13.0	51.5	2.5	5.5	52.9	2.3	4.4	60.0	20.0	60.0	20.0	60.0	20.0	6.1	5	3	S	70.8	-	-	-	-	-	-	-				
Krasnojarskij 1	CN30528	Russian Federation	2	50	3	22.9	61.3	19.2	8.7	51.5	2.8	-	-	-	-	-	-	-	-	-	-	5	3	S	70.8	-	-	-	-	-	-	-	-				
Kun Lun No. 3	CN29682	China	6, H	66	4	16.5	100.0	58.1	39.8	51.5	4.5	-	-	-	-	-	-	-	-	-	-	3	3	MS	80.8	-	-	-	-	-	-	-	-				
Nan Fan No. 3	CN29683	China	6, H	71	3	5.7	100.0	57.3	32.7	54.0	2.8	10.7	98.7	33.3	23.3	7	6	7	6	7	6	23.3	7	6	MR	5.3	-	-	-	-	-	-	-				
Ussurijskij 8	CN29401	Russian Federation	2	54	2	23.5	40.0	11.7	6.2	51.0	2.8	-	-	-	-	-	-	-	-	-	-	8	5	S	85.8	-	-	-	-	-	-	-	-				
VINER	CN99481	Russian Federation	2	56	3	23.5	46.7	11.7	17.1	52.0	3.3	-	-	-	-	-	-	-	-	-	-	7	4	S	75.8	-	-	-	-	-	-	-	-				

* Note: Lines advanced to 2003 tests.

¹ 2 = 2-row, 6 = 6-row, H = hullless, P = pigmented seed.

² Growth cabinet inoculation of isolates 857 (spot form net blotch) and 858 (net-form net blotch) of *Puccinia horrida* leaves. Scale = 1-9 where 9 is susceptible.

³ Growth cabinet inoculation of isolates 1493 of *Rhynchosporium secalis* (scald), where R= resistant, MR= moderately resistant, MS= moderately susceptible, S= susceptible.

⁴ Stem Rust race QCCJ. Rating x where x = % severity and y = infection type. R= 1, RMR= 2, MR= 3, MRMS= 4, MRMS= 5, MS= 6, MS= 7 and S= 8.

Inoculated in a disease nursery at Brandon, MB.

Table 12. New FHB resistant Plant Gene Resources of Canada (PGRC) accessions tested in 2002.

NAME	CN code	Origin	Type ¹	2002			2003			China-02-03		
				Days to	FHB	DON	Days to	FHB	DON	Diseased	Diseased	Diseased
				Heading			Heading			Spikes(%)	Index	Seeds(%)
AC Metcalfe	check		2	51.4	2.1	8.8	54.0	2.8	17.5	-	-	-
CI4196	check		2	61.0	2.7	6.5	61.5	1.8	7.4	23.3	5.8	2.4
Stander	check		6	48.0	4.1	11.9	52.5	5.0	22.1	100.0	36.7	22.4
CDC Sisler	check		6	49.0	2.6	4.7	53.0	2.8	7.9	73.3	24.2	10.3
Chevron	check		6	50.6	1.0	3.0	52.0	0.8	6.8	-	-	-
Robust	check		6	48.6	3.6	10.5	49.5	3.3	18.1	100.0	40.4	16.8

Germplasm previously identified by Dr. B. J. Steffenson

CIho-4095	CN58893	Georgia	6	54	3.5	10.0				96.7	28.3	15.1	*
CIho-4530	CN91712	China	6	49	1.5	7.1				100.0	26.7	12.5	*
CIho-6613	CN59665	United States	6	51	1.5	2.3	52.7	1.8	8.9	46.2	11.5	3.2	*
CIho-9114	CN94373	Yugoslavia	6, H	51	2	6.1				70.0	17.5	3.7	*
CIho-9699	CN94814	Ethiopia	6	59	4	-				-	-	-	
CIho-11526	CN60822	United States	6	54	2	5.0	55.0	1.7	3.7	-	-	-	
CIho-16128	CN62899	United States	6	51	2	4.9	55.0	1.3	3.5	18.2	4.5	1.8	*
PI-328642	CN69053	Romania	6	58	4	-				-	-	-	
PI-370919	CN74187	Switzerland	6, H	52	1.5	17.3				71.4	19.6	5.5	
PI-371308	CN74573	Switzerland	6	49	2	7.8				76.7	19.2	4.5	*
PI-371317	CN74582	Switzerland	6	49	2	8.2				68.8	20.3	21.8	*
PI-467654	CN83193	Finland	6, H	55	3	15.2				-	-	-	

Previously unscreened germplasm from PGRC

CIho-2443	CN58480	Iran	2	44	1	5.3				-	-	-	*
CIho-3957	CN91465	Georgia	2	45	2	3.3				-	-	-	*
CIho-4089	CN58888	Georgia	2	45	1	4.8				-	-	-	*
CIho-5535	CN92127	Ukraine	2	52	1.5	4.9				-	-	-	*
CIho-9150	CN60238	Turkey	2	42	2	2.4				-	-	-	*
CIho-9979	CN60364	Ethiopia	2, H, P	46	2	4.8				-	-	-	*
CIho-9989	CN95180	Iran	2, P	44	2	2.3				-	-	-	*
CIho-10266	CN60477	Ethiopia	2	46	2	3.3				-	-	-	*
CIho-11706	CN60923	Ethiopia	2	49	2	3.4				-	-	-	*
CIho-11709	CN60925	Ethiopia	2, P	58	2	4.5				-	-	-	*
CIho-12302	CN96016	Ukraine	2	49	2	3.9				-	-	-	*
CIho-12439	CN96134	Israel	2	52	2	3.5				-	-	-	*
CIho-14360	CN61798	Ethiopia	2, P	44	2	2.2				-	-	-	*
CIho-15262	CN62203	Ethiopia	2	38	0	3.9				-	-	-	*
CI 2208	CN267	Ethiopia	2	54	2	3.8				-	-	-	*
CI 2208	CN716	Ethiopia	2	52	2	4.4				-	-	-	*
CI 9819	CN2174	Ethiopia	2	61	2	4.5				-	-	-	*
Meh28	CN5293	Turkey	2	51	2.5	4.6				-	-	-	*
Meh80	CN5302	Syria	2	51	2	5.3				-	-	-	*
396	CN5317	Ethiopia	2	46	2	1.0				-	-	-	*
397	CN5318	Ethiopia	2, P	46	2	3.6				-	-	-	*
398	CN5319	Ethiopia	2, P	44	2	3.8				-	-	-	*
428	CN5329	Ethiopia	2, P	49	2	3.7				-	-	-	*
Odesskij 36	CN32584	Ukraine	2	44	2	5.1				-	-	-	*

* Note: Lines advanced to 2003 tests.

¹ 2 = 2-row, 6 = 6-row, H = hullless, P = pigmented seed.

